The Welding Engineer

Edited by L. B. Mackenzie

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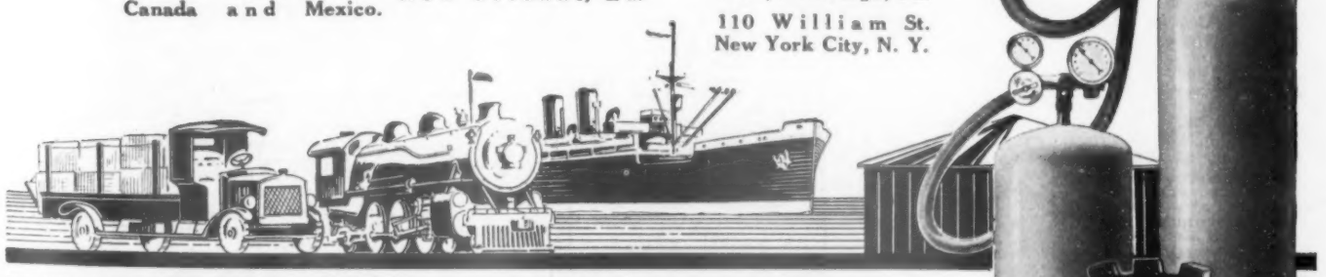

WELDING
PUROX
CUTTING

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Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

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Cuts and Welds

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The Alexander Milburn Company has specialized, since 1912, on Combination Torches which will both cut and weld. This Company has steadily made advances and in 1916 developed its present well-known Combination Cutting and Welding Torch covered by basic patents the world over. In this torch, which has become standard in numerous railroads, government departments and industries you merely change the tips for either cutting or welding, thus eliminating separate torches and equipment.

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Acetylene	8.3%	23.6%	27.7%
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Circular 35 tells you more about this torch—Write now.

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ALPHABETICAL INDEX TO ADVERTISERS

Air Reduction Sales Co.....Front Cover
American Welding Society 47

B
Bastian-Blessing Co., The.....26-27
Bierman-Everett Fdy. Co..... 50
Buffalo Dental Mfg. Co..... 16
Burdett Mfg. Co..... 11

C
Carbic Mfg. Co.....Inside Back Cover
Central Steel & Wire Co..... 43
Chicago Eye Shield Co..... 49
Chicago Steel & Wire Co..... 8
Commercial Acetylene Supply Co..... 9
Wm. Cramp & Sons..... 16

D
Davis-Bournonville Co..... 50
M. Keith Dunham..... 12

E
Elec. Arc Welding & Cutting Co...Back Cover

G
Gas Products Assn..... 5
Gas Tank Recharging Co..... 14
General Electric Co..... 35
Gibb Instrument Co..... 43

I
Ideal Face Shield Co..... 14
International Oxygen Co..... 50
Imperial Brass Mfg. Co..... 50

K
K-G Welding & Cutting Co..... 16

L
Linde Air Products Co..... 18

M
Mackey & Harris, Inc..... 12
Manganese Steel Forge Co..... 49
Mattingly Automatic Valve Co..... 48
Alexander Milburn Co..... 5
Modern Engineering Co..... 49
Morey Flux and Chemical Co..... 50

N
National Carbon Co..... 50

O
Oxweld Acetylene Co..... 3

P
Page Steel & Wire Co..... 13
The Prest-O-Lite Co., Inc..... 31
The Purox Co..... 3

Q
Quasi-Arc Weldtrode Co..... 50

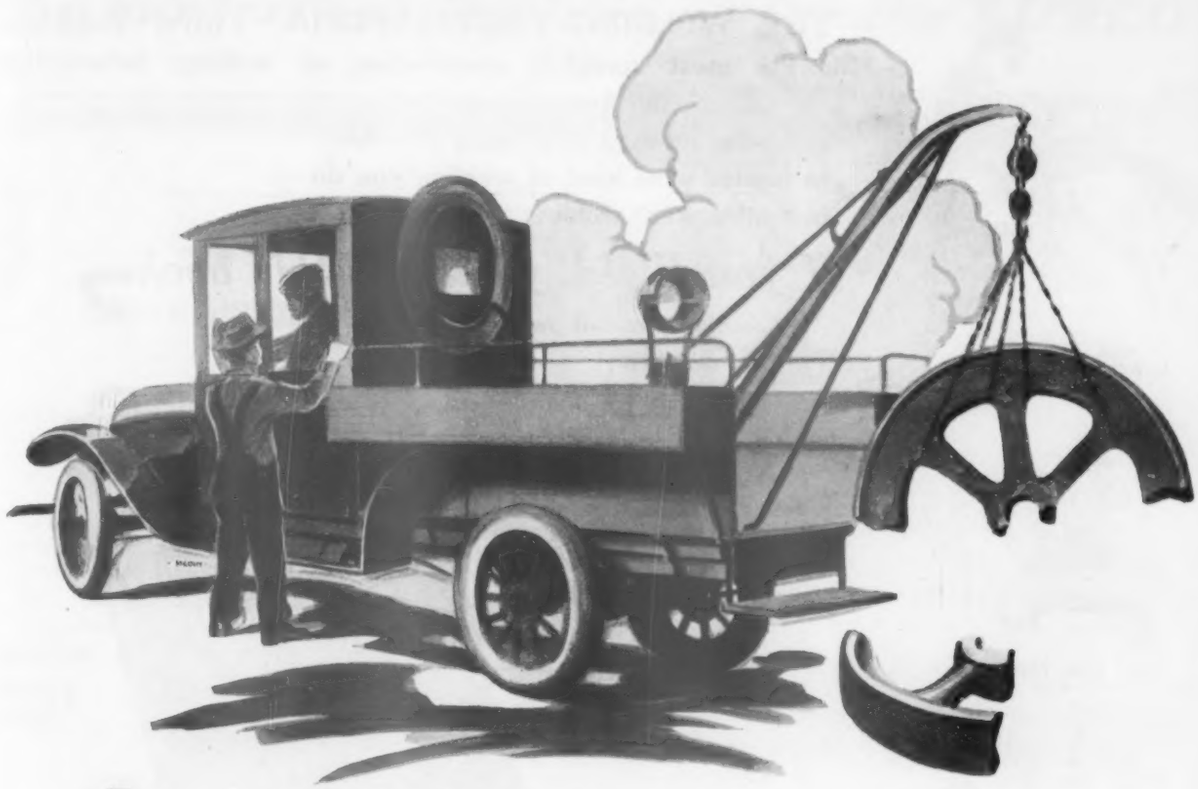
R
Reid-Avery Co..... 15
Rochester Welding Works..... 4
Roebling, John A., Sons Co..... 17

S
Sall Mountain Co..... 48
C. Sorenson 50
Shawinigan Products Corporation..... 12
Smith's Inventions, Inc..... 13
Superior Oxy-Acetylene Machine Co..... 49

T
Torchweld Euipment Co..... 45
Transportation Engineering Corp..... 14

U
Union Carbide Sales Co..... 7
U. S. Gauge Co.....
United States Welding Co..... 45

W
Welding Metals Mfg. Co..... 50
Westinghouse Electric Mfg. Co..... 50
Wm. Wharton, Jr., & Co., Inc..... 50
Wilson Welder & Metals Co..... 41
Wodack Electric Tool Corporation..... 48



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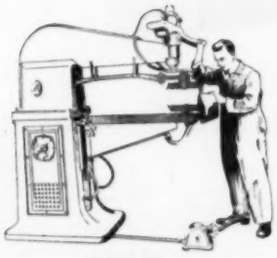

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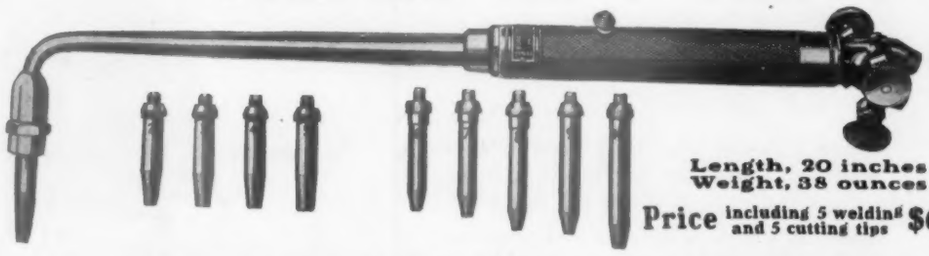

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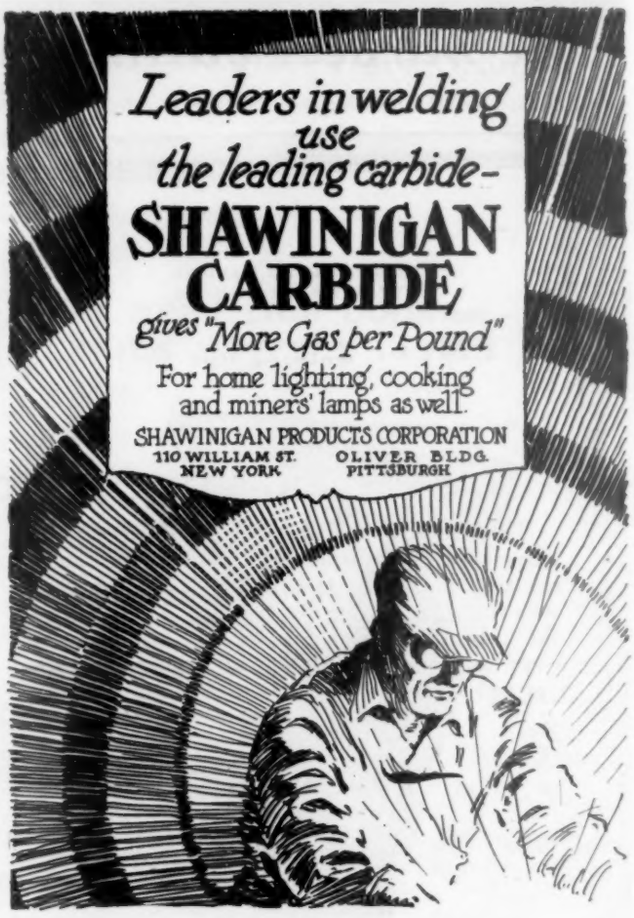

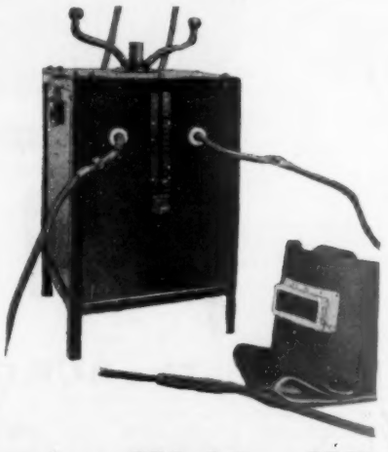

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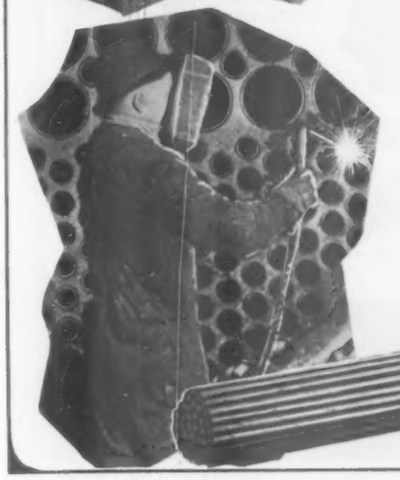

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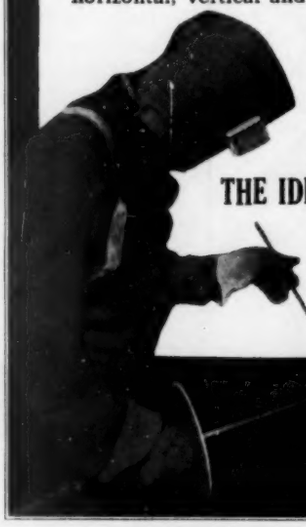

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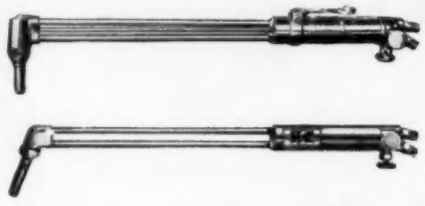

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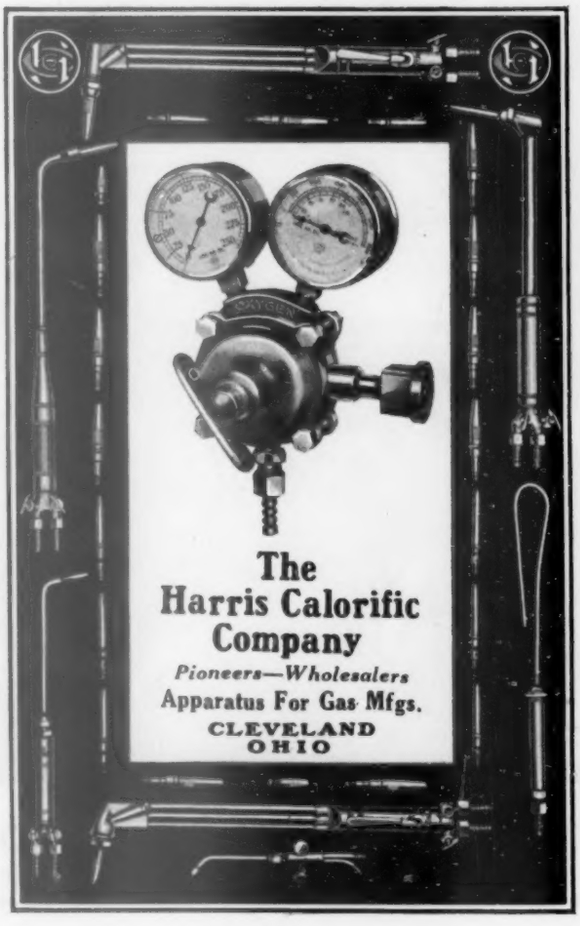

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PRODUCTION BRAZING

Standardized Conditions of Operation Are Necessary for Best Results—Provision for Comfort of Operators

By B. Heyman

ONE PHASE of the oxy-acetylene industry that has received scant attention, is that pertaining to production methods of brazing—particularly those methods which might be classed as semi-automatic. Standardized conditions of operation, the use of properly designed fixtures, rigorous inspection of materials, and well defined methods of applying the filling materials, etc., all tend towards a more uniform product at a rate of speed which results in a lower priced commodity.

Naturally, speed is of prime importance, for upon this single item depend practically all the factors which enter into the brazing costs—labor, gases, power, etc. Yet, to attain a maximum speed, other important considerations must not be neglected. The ability of the operator to perform a set task really defines the speed limit, regardless of possibilities of speeding up the machine. And where the operator is a controlling factor, it is all important to make allowance with a liberal factor of safety for the human element. No matter how expert the workman, there are always certain variables that creep into the process and which must be offset somehow by the skill and ability of the man in charge. Where machine methods are in use, a fair allowance of time for such emergencies is absolutely required and should be considered, not as lost time or wasted effort, but as a charge offsetting a possible worthless product. And in any shop where such methods are in use, and where accurate costs are kept there can be no doubt in anyone's mind as to the comparative value of such a proceeding.

The human element is all important in the majority of manufacturing processes. In connection with brazing applications it is difficult to actually define its importance. It is to be expected that the brazer has the skill requisite in one handling oxy-acetylene apparatus; but even more than that, where the methods are semi-automatic, he must be unusually wide-awake and always on the alert. Constant attention to conditions that are tending to vary, such as the gas pressures, the action of the materials in use, etc.—necessitates manipulation of the apparatus and machine, or the set standards can appear to be that in name only.

Eliminating the human element temporarily, the question arises, does the product itself have any effect on the speed? Where brazing is resorted to, in constructing a commodity, there is certainly an importance attaching to the product as regards the speed, which cannot by any means be ignored. Naturally, the design, materials, specifications, and machining methods if any, all determine this point.

Perhaps this may seem somewhat incomprehensible to the layman. He cannot see why, if an object can be made in 4 minutes, and it is known that the limit of operating speed has not by any means been approached, a possible reduction of the speed by half a minute may produce worthless results. Yet this is actually the case under certain conditions where different materials are to be joined by brazing methods. Questions of expansion and contraction, heat conduction, fluxing, etc., all affect the final product and the difference in time saved, though appreciable, may be insignificant as compared to the loss incurred by rejected material, incapable of being salvaged.

In the opening paragraph of this article mention was made of material inspection. On machine brazing operations where certain set conditions are used, it follows that the materials in use must adhere very closely to certain specifications, otherwise similar conditions cannot possibly be maintained on the work. Since the materials in use are few in number they are enumerated as follows:

Flux
Spelter (when used)
Brass or bronze rod
Oxygen
Acetylene
Puddling rods (when used)
Asbestos, etc.

For the ordinary small concern performing machine brazing operations it would be utterly impossible to test by chemical analysis every item listed. In fact it would be ruinous even to attempt it, so that, the logical thing is to purchase from reputable concerns that guarantee their products, and then test by actual use on a small number of pieces, the particular new lot of material. In other words, where a new lot of flux were received, a test would be made in a regular run of material, using materials known to be satisfactory, excepting that on a few definite pieces, properly marked, the new flux would be used. These pieces would then be examined very carefully before and after machining and some simple physical test applied to determine whether the flux had actually served its purpose. The same method applies to the other materials, i. e., the spelter, filler rod, and gases.

Large organizations generally maintain experimental laboratories, and for these the safest practice would be to determine by chemical analysis whether the materials were of the proper specifications. In the case of the filling rod in particular the zinc content must be a definite value, since a definite quantity is volatilized where all conditions are kept standard. If this zinc content runs outside specified limits it is difficult to assign the responsibility for unusual defects in the finished article.

Slight moisture content in the oxygen cylinders, or differences in purity, which on ordinary welding or brazing work would hardly have any effect cause noticeable differences in machine operation and for such possible occurrences the brazer must ever be on the alert.

To some extent, the latter conditions can be remedied by proper management and supervision. Cylinders of the later serial numbers can always be depended upon. The use of manifolds, elimination of unusual temperature conditions, allowing acetylene cylinders to stand a sufficient time to offset jarring actions in delivering all help.

But the actual physical test on the product is, after all, the final test and it is this which really determines whether the particular lot of gas or filler rod or flux can be used.

Apparatus used for the process must be of the best, and at all times in the finest of working condition. Since deterioration of rubber hose (even if very short lengths are used to connect rigid metal pipe lines) causes small particles to be carried into the torch and gas mixing chambers, these must be examined frequently for passage obstructions. It is needless to remark that all connections should be perfectly sealed to prevent gas leakage.

Regulators used for machine brazing are probably the most important parts of the equipment, since the type and intensity of the flames depend upon certain definite pressures. Any change, no matter how slight, in the position of the pointer

of the low-pressure gage will affect the entire process. Therefore, it behooves the operator to check the calibration of these gages at frequent intervals.

As stated above, slight pressure changes affect the operation, and it is advisable to afford the brazer every possible means for noting these fluctuations as they occur. To depend upon the standard gage markings is to invite trouble. The average manufacturing department is rarely so well illuminated, that an operator, protected by his welding goggles, can notice a change in pressure which may only amount to the thickness of one of the markings. And yet, so slight a change may mean a great deal in the ordinary machine routine, especially where the process entails several stages, using a number of torches, each functioning in a different way, but all synchronized to produce a single result.

A simple means, for avoiding this condition is to substitute a mercury column to register the settings, each setting being an empirical value and having a direct relation to the gages which are ordinarily used. When the marking on the regulator gage provides for a spacing of perhaps ⅛ inch to the lb. per square inch, on the mercury column the same distance is magnified enormously. In this way the operator has ample means for noting even the most trifling change and can immediately compensate for it. It is very necessary, also, that proper thought be given to illuminating such a pressure column; also to the method of mounting in order that a striking contrast be produced between the silvery color of the mercury and the background upon which the column is mounted.

The torch tips should be examined very regularly and thoroughly cleaned. As the quantity of gas delivered for any specified pressure depends upon the discharge area, even a slight deposit at that point may cut down the capacity of the torch very appreciably. It will be found that the zinc oxide deposit accumulates rapidly at the tip extremity necessitating very frequent removal.

It should be unnecessary to recommend care in handling the tips. Slight imperfections in seating or in the orifice may cause backfires, which, though in no way serious in themselves may affect the process or cause the loss of some of the product, especially where the process is in several stages all synchronized, such as a preheating stage and finishing stage each dependent on the other. Naturally if a backfire occur in the preheating stage the part will not have acquired sufficient heat when the indexing occurs to the finishing stage.

From the fact that the brazing methods are semi-automatic it is to be assumed that some particular function is performed either by a device or machine. The ideal condition would be the one in which the entire process were made a mechanical one, but in so far as the oxy-acetylene industry as applied to brazing has not advanced to this stage it is hardly possible to conceive any such condition excepting in certain unusual operations which will be considered in a later article.

However, there are certain devices and fixtures which can be used advantageously, provided proper attention and knowledge attend their design and manufacture, and it is to such devices mainly to which is attributed the success possible in machine brazing methods. It must not be assumed from this fact that for every production job there is an automatic or semi-automatic method, but for the majority, where there is a straight run of work it is possible to eliminate such operations as ordinarily fall to the lot of the operator and which can just as well be performed by a mechanical contrivance.

This applies particularly to the methods of holding the work and bringing the work under the action of the flame. As an example with which most of us are familiar we might go back to one of the best known machine welding processes, namely, that of tube welding. Examples in brazing work will be given in another article, but it is worth while bringing to our attention the tube welding machine because of its present high state of perfection. The tube is aligned to permit the butted edges to pass directly under the multiple flames and means are provided for adjusting the torches and for adjusting the pressure on the tube walls. The operator is, in this way, allowed every facility for controlling the weld as it progresses and can compensate for any changes which may occur from time to time.

In brazing, however, there are usually no possible changes permitted in the position of the torches, excepting in certain extreme cases and also since an external filler must be applied in many cases, the operation does not generally class as a purely machine operation.

Interesting problems generally develop in the design of welding devices for the product. Expasion and contraction cause the greatest difficulty, but even these can be overcome by proper observation and application of engineering principles.

Before closing this article it is advisable to consider several factors that affect the operator's morale and which are most assuredly of enough importance to be studied and provided for in any brazing work. These are the matter of ventilation and removal of the zinc oxide fumes, and the question of eye protection from the oxy-acetylene flames and flux glare while operating.

By means of exhaust fans and hoods the zinc oxide fumes can be handled without any difficulty. Such an installation is inexpensive. Also its operation cost is low. The value derived from the operator feeling free to continue on his work without any dread of serious effects and the elimination of possible lost time from such serious effects are in themselves sufficient to offset the cost of installation and operation.

A factory in which the walls, ceilings and machinery are thoroughly coated with a dirty white powder which is generally swirling around and being inhaled by the workman is not one in which an employee will remain for any length of time. "Turnover" is an item which creates an enormous burden, particularly on work which requires long periods of instruction with consequent loss of production. Therefore it behooves the management to provide for this condition right from the start of the brazing work and to maintain the ventilating apparatus in good operating condition at all times.

The matter of eye protection is one that is usually left in the hands of the individual, an unusually poor state of affairs, when it is realized that the operator is rarely ever a person with sufficient knowledge or training to choose correct protective devices.

On ordinary hand brazing work there are many standard goggles which suffice. However, on machine work a different condition exists and the ordinary goggle becomes unsuitable for a number of reasons. The work must be inserted in a fixture. If lighting conditions are not of the very best—and they seldom are—it becomes almost impossible to remove finished work and insert new work without raising the goggles. Naturally, removing the goggle removes the protection.

Since the work is of a continuous nature and from the conditions imposed, it becomes necessary to prepare the product with a flux preparation. Under the action of the oxy-acetylene flame the flux generally produces an unusual glare, which produces severe eye-strain after the operator has been performing his task for any period. The use of asbestos for protecting the product also magnifies the glare as it becomes an intense white when the flame has played on it for a short interval of time.

On some operations, it becomes almost impossible to offset all the unusual conditions that may exist. Yet, it is possible to eliminate most of the objectionable features by simple means, provided the cooperation of the brazer is secured. Shields of heat resisting material can be interposed to check the direct rays from the inner cone of the flame.

A goggle of the correct shade to eliminate the glaring ele-

ments and also the reflected active rays from the flame, while possessing enough visibility to permit manipulation of the fixture and the product can be secured from a number of the larger and reliable goggle concerns who specialize in such products.

But, as has been remarked above, it is only by the cooperation of the management and the employee that the best results can be secured. It does not serve the purpose, if the management provides the equipment and then finds the operator using something else which he feels is perfectly satisfactory but which may have many shortcomings for the particular work in hand. The inevitable result (eye-strain), causes financial loss to both parties and usually the departure of the brazer from this factory in search of different work where he will not be under the influence of the powerful active rays.

In another paper will be given a description of the devices and methods employed in carrying through a series of machine brazing operations on a single product in which numerous difficulties were encountered both from an engineering standpoint in design and also from the operating standpoint in the shop.

(To be continued)

WELDING STELLITE WITH THE OXY-ACETYLENE TORCH*

By Herman Ullmert

PERHAPS the best way to describe the method of procedure for welding stellite with the oxy-acetylene torch is to compare it with the welding of steel.

Flame

For welding steel a neutral flame is used, while for welding stellite it is necessary to use a reducing flame, that is, one with a long white cone of excess acetylene. This is a low temperature flame that keeps a blanket of burning gases over the metal which is to be welded and prevents overheating and oxidation of the stellite and the formation of blow holes. It is absolutely essential to the making of satisfactory stellite welds to use this type of flame, but because of its low temperature it is also necessary to use a larger tip than would ordinarily be used for making a weld of the same size in steel. For example, if for welding two pieces of steel a No. 8 tip would be selected, for welding stellite of the same size a No. 10 tip should be used.

Temperature

Wherever possible the article to be welded with stellite should be preheated to a bright red before beginning the work with the torch. Where for steel it is generally sufficient to keep the immediate portion of the weld hot with the torch, in the case of stellite much better success is obtained if a considerably larger portion of the metal to be welded is kept hot. On the other hand, it is not necessary to heat any portion of the parts to be welded with stellite as hot as when the welding is to be done with steel.

Types of Welds

Stellite welds are generally of two types, either a piece of stellite is welded to a piece of steel or cast iron using stellite filler rod, or two pieces of stellite are welded together using stellite filler rod. In many cases one of the pieces of solid metal is omitted and a layer of stellite is built up on the other piece by depositing it from the filler rod. A stellite tip welded to a steel tool shank or the building up of a stellite surface on a steel die are examples of the first type of weld, while the repairing of defects in stellite castings is an example of the second type. The welding of stellite to steel or cast iron is the type of weld most frequently made, and if this can be carried out successfully there will be no trouble in making the other type of weld.

Welding Operation

When a reducing flame is played on a piece of steel, the steel becomes coated with a layer of carbon and some iron oxide. Anyone welding stellite to steel with this type of flame for the first time will find it to his advantage to use a small amount of flux, such as Brazo flux, to help clean the steel of its coating of carbon and oxide. It is not desirable, however, to remove this coating or crust entirely, and with more experience the welder will probably dispense with the use of the flux entirely. Before any stellite is deposited on the steel from the rod, the steel should be brought to such a temperature with the torch that the stellite will just flow on it. This temperature can be determined only by experience, but it is more nearly the temperature used for brazing steel than for welding steel; in fact, the whole operation of welding stellite to steel is more nearly a brazing than a welding operation. The steel should not actually be melted under the torch, but when it is just short of this temperature stellite is run on it from the filler rod and it will immediately run under the crust of carbon and iron oxide and spread out into a thin film on the surface of the steel. From this point on the torch flame should be directed at the end of the filler rod and the stellite will continue to flow smoothly and uniformly over the surface of the steel without at any time breaking the crust which rises from the surface of the steel and floats on the stellite.

It is absolutely essential that this crust be floated up everywhere, for if it remains adhering to the surface of the steel a blow hole will be formed in the stellite. The filler rod should not be dipped into the puddled stellite on the surface of the steel, but it should be held still in the flame and not used to stir the puddled metal. The entire surface of steel which is to be coated with stellite should be covered with a thin layer first before any attempt is made to build up a thick coating. After the surface has once been coated the remainder of the operation becomes a weld of the other type, namely, stellite to stellite. This type of weld has no essential difference from that of stellite to steel, except that still less temperature is required. The stellite should be flowed on in the same manner without breaking the crust, using as little heat as is necessary to flow the metal evenly and smoothly.

If the steel is heated too hot or actually melted under the torch before the stellite is flowed on, the steel will alloy with all of the stellite at once and the deposited metal will consist of an alloy of stellite and steel high in iron instead of a thin layer of this alloy on top of which is stellite in which the iron content decreases as the distance from the surface of the steel increases. The layer of alloy in a good weld should be very thin and the deposited metal should be practically pure stellite. If this is not the case the properties of the deposited metal will not be so good as when the welding is done at a lower temperature and when the layer of alloy is thinner.

The welding of stellite to cast iron is essentially the same as the welding of stellite to steel, except that the cast iron flows more freely and at a lower temperature and less heat is therefore required. To anyone already familiar with welding the difference between welding stellite to cast iron and to steel will present no particular difficulty.

It is not expected that this description will enable anyone to make a successful stellite weld on the first trial, as considerable experience has been found to be necessary. Very satisfactory welds are being made regularly by this method, however, and an experienced welder should be able to work out the method for himself in a short time if it is borne in mind that the welding of stellite is more like the brazing than it is like the welding of steel, and that it is absolutely necessary to use a reducing flame.

**Paper presented to the American Welding Society at the meeting of the Chicago Section, November 2, 1923.*

‡Linde Air Products Co.

JOBS FOR MEN AND MEN FOR JOBS

A Gas Manufacturer Finds That It Pays to Conduct a Systematic Employment Service in His Territory

By Grady Triplet

OUT of a few efforts to find work for welders, the Magnolia Gas Products Company of Houston, Texas, has developed an employment service, which works to the direct benefit of both employers and welders, as well as indirect benefits to the company. The service has grown into a clearing house for welders. Concerns needing a welder, either permanently or for a short time, communicate their wants to the Magnolia company. From the file of welders available, those qualified to do the work are selected and their names given to the concern. Welders leave their names with the company to await a call for work.

When some big welding job is soon to be finished, Mr. Wood knows there will be a bunch of welders out of work. He has a salesman or some representative of the company inform the welders that the company will be glad to do all it can to find other work. They are invited to leave their names, with all necessary information. By this method, welders frequently are sent to another job as soon as released from one.

While the service started in an effort to assist the customers of the Magnolia Gas Products company and the welders using its equipment, it has outgrown that. Nothing is asked about

Name..... Date.....
Address .....
Phone .....
Ask for.....
Gas or Electric.....
Nature of Work.....
Apparatus Used.....
Experience Required .....
Pay .....
Union Shop? .....
Remarks .....

Name..... Date.....
Address..... Phone.....
Is Address Permanent?..... Married?.....
Nationality..... Pay Desired.....
Why Did You Leave Your Last Job?.....
Where Did You Learn Welding?..... When?.....
Experience .....
Books or Magazines Used?.....
Makes of Apparatus Used?.....
Have You a Specialty?.....
Remarks .....

Forms Which Aid in Conducting an Employment Service.

The service is conducted by O. L. Wood, superintendent of the company. It is without cost to welders or employers. Mr. Wood some two years ago had occasion to know of an expert welder being out of work. He remembered the man when some weeks later a customer had need for a welder. The result was that the welder was given employment that became permanent.

The incident caused Mr. Wood to reflect on the possibility of being of similar service to other welders and other customers. So he made it a point to remember men without welding work. Having them in mind, he was more prompt to look for opportunities to put them to work.

From these efforts the service began to grow until his memory no longer would serve. So he fixed a small file, using ordinary 3x5 cards. After finding work for a few welders, the service became common knowledge among welders, who began going to the Magnolia office each time they needed work, to ask for employment. If Mr. Wood had no openings listed, he took addresses, telephone numbers, with data as to the experience and ability of the welders.

The same file serves for listing the concerns needing welders. So it has become an automatic system. At times there may be a score of welders listed for work. Later these may have been placed and he will have unfilled calls for welders. When a welder is sent to a job, his card is destroyed and he is told to list his name again if he wants work.

Many of the welders sent to jobs are known to Mr. Wood, who sends a message to the employer, telling of the qualifications of the applicant and also stating what the man should be able to do. If a welder is not known, a message is sent to the concern needing the welder, explaining that the Magnolia company knows nothing of the man's ability. The message, usually by telephone, informs the concern what class of work the welder says he can do.

All this serves to keep the position of the Magnolia Gas Products company clear with its customers.

that. All Mr. Wood wants is the name of a welder. In fact he rather likes to be of this sort of service to concerns seeking work and the name of the concern seeking such a welder not using Magnolia products.

"None of it is done for direct sales purposes," he admitted, "but we hope to profit from it indirectly. If we can be of service to our customers it is going to give a closer touch in selling them products. Then if we can be of service to some concern not using our products, the time may come when that will give us an opportunity to win that concern as a customer.

"Or, if we place some welder, knowing our products, with a concern not buying from us, that man may work himself into a position where he will do the buying for his concern. When he does, we can rest assured that we are going to get consideration when he buys. After that the products will have to be sold on their merits but the chance is something not to be overlooked.

"Then it's all part of the game. It's a way to keep men employed and to keep industries supplied with competent labor. With that more welding products are to be used and we're trying to sell our share."

Recently the employment service has been advertised. The Magnolia company uses two column, three-inch space in the industrial section of two Houston newspapers once a week. Frequently the service for employing welders or furnishing industries with welders is outlined in this space. This has served to broaden the scope of the work, while the value of the space for advertising purposes has been held up to par.

The cards reproduced above are the regular 3x5 size used by *The Welding Engineer* in carrying out this same type of welding employment work in Chicago. The Chicago office of the Gas Products Association also uses this same form with good results and the number of jobs which have been satisfactorily filled and in short order prove the worth of such an employment method for welders.

"PRECISION" ELECTRIC WELDING*

Jobs Which Require a Complete Practical Knowledge and Understanding of Expansion and Contraction of Metals

By S. W. Mann†

THE welding art has so many branches and is growing so rapidly, that the expert must be a specialist. The writer is, therefore, content to follow one method and to apply himself to the promotion of that one particular branch. The electric arc method has been selected primarily because of its flexibility and wide application and economy. The writer's particular purpose here is to call attention to what can honestly be called Precision Welding—not almost correct, but within two thousandths of an inch. It was not so long ago that even the machining of a large crank shaft to two thousandths of an inch tolerance was not an easy problem, especially when its assembled or complete weight was between five and seventy-five tons. Today, however, this is the standard tolerance and is lived up to by reliable engine manufacturers.

It is now possible, through the use of precision instruments, that are capable of measuring the alignment of a shaft that is assembled in an engine frame, and the electric arc process, to repair or straighten a broken or twisted shaft or a broken casting to the same degree of strength and accuracy as that required by the manufacturer. We can, to a considerable degree, correct machining faults in large machined pieces, even after considerable use, and when age, with its normalizing influence has caused a warpage or springing of the crank shaft, due to original forging strains, we can straighten the shaft within its original tolerance at a very small cost of labor. When we say "equal to the original tolerance" we do not mean in one particular measurement, but in all of them, of which there are many on a multiple throw shaft. Its warped condition, after use and age, is produced by the natural tendency of the original forging strains to neutralize or equal one another. As a result, a shaft that might have been machined to a tolerance of one thousandth of an inch may, in the course of time, even though it be kept in storage, incur a warpage of ten to fifteen thousandths.

The classes of work coming under the head of precision jobs not only include crank shafts of steel but cast iron or cast steel as well and the term can be employed wherever a large mass of steel requires bending, straightening or twisting. The crank shaft may become twisted in various ways. It may be that the fly wheel of an engine is suddenly stopped. The inertia is liable to twist the section between the fly wheel and the crank throw or counterbalance weights, or in another instance, the cylinder may, during the course of starting the engine, come up against a water head and in that case, the inertia of the fly wheel would produce a tendency to twist the shaft. In multiple throw engines, we have on record cases of broken connecting rods or piston rods that caused sudden stopping of one particular throw and the momentum of the balance of the moving parts produced twisting in one or more places. This twisted condition can also be overcome, within certain limits, by the electric arc.

Suppose a high pressure cast iron cylinder should have its whole flange broken off completely around the cylinder, due to a broken or loosened piston rod or water head. Although a delicate problem, it is a practicable undertaking to replace this flange on all cylinders over two feet in diameter and also to have all of its gasket face tolerance equal to the original. In undertaking work of this nature a complete practical knowledge and understanding of expansion and contraction of metals is necessary. A technical knowledge is desirable but not a necessity. The operator or supervisor must thoroughly understand the use of precision instruments, some of which he must be capable of devising himself to suit the individual problem confronting him. Low voltage is preferable, due to its limiting the possibility of burned or porous metal caused by the long arc. The welding current should not exceed 150 amperes and should be well regulated so that it can be held constant at all times, regardless of the variations of the arc length, due to the human element. Such control of the current means that regardless of the area of the weld or puddle of molten metal under the arc, the heat per unit area of this puddle will be constant.

The process and method of repairing a crank shaft can be called a Neutralized Precision Weld. One shaft in particular, when completed, was under a tolerance of 1¼ thousandths of an inch. The process in this and similar work is briefly as follows:

The fracture, whether it lays directly in the crank pin, main shaft or web of a shaft, should be chipped off from the opposite sides, where possible. In a round section, it should be chipped to a point, leaving a "V" of approximately ninety degrees between the two pieces when they are assembled. The metal should be thoroughly clean and free from carbon pockets or shrinkage cracks before attempting to weld. The two parts are then placed together with the points of the "V" or chipped section in line with each other and with an opening between them of ⅛" or more, so that complete fusion of the added metal with either side of the "V" may be obtained.

The next step to be taken is the alignment of the work which, without question, is the most difficult problem encountered in the whole repair. Provision must be made in the original alignment for shrinkage of the metal in the primary weld tacking the two pieces together. When this alignment has been completed and the connecting weld is made, check measurements should be taken from all angles. It is often found that the shrinkage of the tacking weld is greater or less than anticipated and within reasonable limits, such errors can be corrected by the use of a peening hammer to affect an expansion, or, if contraction is required not exceeding three or four thousandths of an inch, the application of one additional layer may give the desired result. In no case should a contraction be allowed to remain in more than two layers of the original connecting weld. When the error in alignment exceeds three or four thousandths in either direction, good practice makes it necessary to chip out or break through this original weld and then start over again. The operator may have to repeat this operation many times before an absolute zero point is obtained. When this has been accomplished, the difficult part of the job is past.

The process from then on consists solely in the repeated application of single layers of metal on all sides of the weld. If desired, each layer may extend over the whole fractured surface. Shrinkage strains, which will be set up in each layer, are removed by the use of a peening tool. Additional metal must not be applied at any time until all shrinkage of the metal already deposited has been relieved, so that all

Paper presented before January meeting, Pittsburgh Section A. W. S.

†*H. Kleinhaus Co.*

indicators reach zero. It is advisable, during the application of a layer, to occasionally watch the indicators to acquaint oneself with the location and the amount of the actual stresses. By continued observation of the micrometers along with the welding, a perfect understanding of contraction can be obtained. This same observation is advisable during the peening process so that the operator may familiarize himself with the actual amount of peening required to effect a neutral weld. The understanding of contraction and expansion, as above outlined, will, in the course of a short time, enable the operator to estimate very closely the amount of peening necessary on work where the use of precision instruments is not practicable and should prove a very valuable asset to any operator.

The extent of contraction varies considerably and usually is in direct proportion to the variation in carbon in the electrode metal. As is readily understood, contraction stresses set up by a hard high carbon metal will produce more of a deflection or shrinkage than those of a soft metal, and the hard metal also requires an additional amount of peening to accomplish the neutralization. Any deflection sideways in the welding of the crank shaft may also be corrected by peening. It is absolutely essential that no more than one layer be applied over the entire surface of any precision weld before peening. It is definitely proven that the expansion produced by the miniature forging blows of a pneumatic hammer do not forge the metal any deeper than ¼". The expansion of a second layer on top of a layer that has been applied without peening, will merely create additional tensile stress severe enough to probably cause an invisible fracture in the underlying layer. There are also times when, due to the thickness of a layer, along with its hardness from the use of a particularly hard metal, the contraction stresses cannot be relieved until continued peening has flaked off a certain amount of this surface of the weld. It is a fact that when a thin layer of white, hot metal is homogeneously applied to colder metal, it sets up tremendous strains, and, when applied with a thorough knowledge, can be used to accomplish desired distortions in large steel sections that cannot be obtained in any other manner. It is also acknowledged that this thin layer of metal which has tied up in itself thousands of pounds of pull created by contraction, can readily be normalized or expanded to a normal condition by the means of the forging effect of a peening hammer. Layer upon layer may be applied and treated with micrometers or indicators as gauges, with absolute confidence that, if carefully and accurately done, the finished mass of metal will be absolutely normal or neutral with neither expansion or contraction stresses, thus doing away with the necessity for annealing.

There is also good reason to believe that the forging effect of a hammer increases the ductility and tensile strength of the metal in the same manner as the forging of steel. The full value of the peening process might be compared very favorably with steel forging, insomuch that it flattens out the individual grains of metal and produces an amalgamation between these grains, that is lacking in the original weld. It is definitely known that a grain of pure steel is surrounded by a shell of impurities. In the event of a fracture, it will follow the line of impurities between each grain and does not have to break through the center, which is the pure steel. By peening or forging, this grain is so flattened that it takes on an over-lapping layer effect and the fracture has to make its way through layer after layer of pure steel.

Not only does the peening produce an increased strength, but it makes possible a neutral weld and also the process of obtaining Precision Welding.

When it comes to cast iron welding, the welding world, as a whole, is more or less under the impression that studding of the welded areas is absolutely essential as a safety factor. In reality, where studs are applied without the peening process, they merely help to strengthen a faulty weld. We do not disapprove of studding as we have determined that it is an advantage even when employed in a neutralized or peened weld, inasmuch as it anchors the contraction of the original bounding layer, and permits a greater area of metal to be welded before peening, without danger of contraction becoming great enough to affect a fracture through the thin layer of chilled cast iron directly under the juncture line. We have, in a number of cases where we have had ample time to complete a job, welded cast iron entirely without studs, but when this process is followed, it is necessary to peen every square inch of the steel as it is applied. If this is not done, the strains set up parallel with the weld will be great enough to fracture at the juncture line. We have proven through numerous tests, that the section which usually cracks directly under the chilled area is of higher tensile strength than the actual cast iron itself, but the sheering strain set up at this point, due to the tremendous amount of contraction, is great enough to produce a fracture, even though it had a tensile strength of three or four times the original casting. In cases, where we have followed out the peening theory of one inch at a time, we have accomplished very successful welds without the use of studs, having a parting strength greater than the iron itself.

In making the above statements, it is naturally assumed that the correct welding material is used and on cast iron, there is no one or two welding wires that will satisfactorily fuse with every piece of cast iron. We might also add that the welding rod is, without question, a very important item and should be given as much consideration as the operator or the machine. In fact, successful welding may be divided into three parts of very nearly equal importance—the operator, the machine and the wire. Very often it is found that with the very best of equipment welding results are not satisfactory, due to the use of an inferior welding electrode. In another instance, the operator is not of the interested type.

In our stock today we carry possibly six or seven different grades of wire for use on cast iron and it is usually possible to find one among this assortment that successfully gives a perfect fusion with cast iron. Castings that are older than twenty years have been found in several cases, to contain a considerable excess of phosphorus or sulphur. At times, it requires considerable experimenting to produce a counteracting chemical to overcome the detrimental effects of an excess of sulphur or phosphorus.

When one stops and really figures out the tremendous shrinkage strains set up in a cast iron weld having a cross section of five inches or more, and it is realized that most such welds have been made without provision for relieving the strains, one is not surprised that the welding of cast iron has sometimes not met with commercial success.

It is very gratifying to know that in the last three years, during which time I have directed numerous cast iron welding repairs, not a single failure has developed and this unequalled success is laid directly to the neutralizing process. This work has been done on castings having a cross section as high as ten inches and with weights running as high as ninety tons per unit. In all welding work undertaken, whether it is cast iron, steel or copper, the work has been guaranteed for a period of one year to meet all of the conditions of the original casting or forging, both as to porosity, strength and precision of alignment.

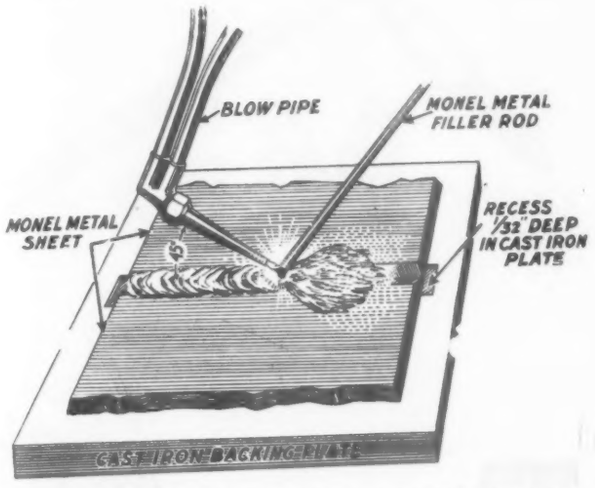
I have attempted, in this article, to show one of the numerous welding repairs that have been accomplished at a very great saving of both time and money and I know of no company today who is employing in their welding department an electric arc welder that is not receiving service many times the value of the installation.

WELDING MONEL METAL and NICKEL*

Correct Procedure for Welding Monel and Nickel by Oxy-Acetylene, Metallic Arc, Carbon Arc and Resistance Methods

MONEL Metal and Nickel can readily be welded by the oxy-acetylene, metallic-arc, carbon-arc, spot and resistance welding, and the practice of welding either metal by any of these methods is very similar to that followed in welding ordinary low carbon steel. This practice is well known to welders and no general description of it will be given here.

There are, however, in addition to those precautions usually followed in the best steel welding, certain further ones which should be observed in welding both Monel Metal and Nickel, and these will be described in detail below. If the welder in attacking a Monel Metal job will observe the usual care which he would in a steel job plus these additional features, he will be entirely successful.



How to Hold Torch and Filler Rod When Welding Monel Metal.

The welding of Nickel is entirely similar to that of welding Monel Metal and, although what is said below will mention Monel Metal only, it applies equally to Nickel.

General Features of Fusion Welding (Arc or Oxy-Acetylene)

The laying out of work in Monel Metal for all types of jobs should be done just as for steel, including such features as bevelling or flanging edges, separating seams for contraction, tacking, use of jigs, etc.

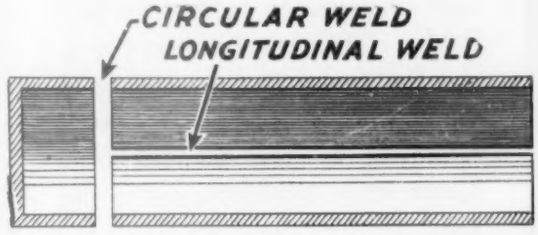
Thin Monel Metal sheets, up to 1/8", should be welded either by carbon-arc or oxy-acetylene flame with flanged edges; above this the edges should merely be butted, and over 1/8" they should be given a 45" bevel in addition. On long seams and on metal over 1/8 thick, a separation of 1/4" to 3/8" per foot may be allowed.

One very important feature of any type of fusion welding is to prevent oxidation of the weld. For this reason welding should be done out of drafts as much as possible, a reducing oxy-acetylene flame should be used and the weld should not be made in layers *but built up completely in one operation.* When this is not done the black oxide scale on the surface of the first weld layer is melted up in the second layer and produces gas holes. A sound weld cannot be made in layers. For the same reason it is very important to file, grind or machine off all black oxide scale from edges to be welded.

All Monel Metal fusion welds should be built up well above the surface to bring any dross or impurities well above the level of pieces being welded, thus securing a full section of sound welded metal.

In welding sheet or plate the edges should be well backed up by carbon or graphite blocks when possible or with steel if these are not available.

Casting must be preheated to a dull red heat before welding; those of large section particularly should be heated in a furnace or by a fire. Allowances must be made for shrinkage and contraction just as in welding cast steel.



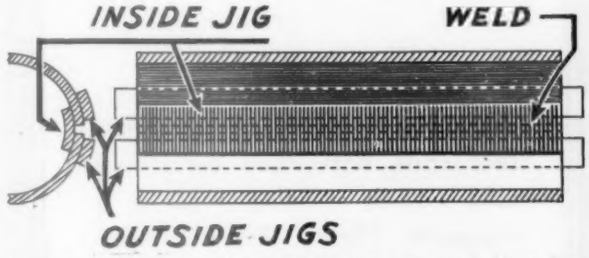
Welding Job on Light Gauge Sheet (up to .062) With Circular and Longitudinal Weld.

Fusion welds will not be as strong as the original metal, just as in the case of steel welds, but in Monel Metal or Nickel welds, properly made, a tensile strength of from 40,000-50,000 lbs. per sq. in. can be depended on with a moderate ductility, sufficient for example that 90° bends may be made in welded 1/4" plate.

Oxy-Acetylene Welding

The principal feature of oxy-acetylene welding is to use a slightly reducing flame, i. e., one which is practically neutral but still on the reducing side. Excess of oxygen is harmful and will cause unsound welds.

A welding tip should be used one size larger than that used for steel work and the flame should be kept covering the weld at all times, thus excluding air and preventing oxidation.



Set-up For Longitudinal Weld in Light Gauge Sheet; Inside and Outside Jigs.

The welding rod should be used as near the weld as possible. Never hold the end away from the weld and allow the metal to drop in. The tip of the rod should actually touch the weld at all times and should not be withdrawn during the operation, as its reintroduction with the black scale formed in the air would cause blow holes.

Oxy-acetylene welding can be done entirely satisfactorily without the aid of any flux, if the edges of the work have been well cleaned. If a flux is desired, however, a very satisfactory one is composed of ground borax, carbon and the deoxidiser alloy described under "Arc-Welding" in the following proportions:

Deoxidiser alloy	2 oz.
Ground borax	2 oz.
Carbon	1/2 oz.

**From a bulletin of the International Nickel Company. These general instructions are adapted as well to the working of malleable Nickel. It is difficult in general instructions to cover every special case that may arise. The Development and Research Department of The International Nickel Company, 67 Wall Street, New York, will furnish instructions covering any specific case.*

ANOTHER RE

The Light Gooseneck For General W

Length 24"

REGO

REGO REGO REGO REGO

Radio and REGO

Marconi didn't invent the radio by being content with the telegraph. He went ahead and improved on an already excellent invention.

In the same way REGO maintains its position as leader in efficiency and adaptability in the welding field. REGO engineers are constantly looking for points in which they can improve or make additions to the present line. Their latest development is the new

REGO Model GM

Gooseneck welding torch. Through scientifically developing the large mixing chamber to its fullest capacity, we are able to offer a medium priced, light weight welding torch which develops a cone ⅜ inches long and 1/16 inch in diameter.

Long, Perfect Cone

The exceptionally fine, long, perfect cone developed by REGO GM makes welding with it a pleasure. Plenty of heat for any sort of work. Its lightness and perfect balance make easy the welds in bad corners and at unhandy angles.

The Bastian-Blessing Co.
246 E. Ontario St., Chicago, Ill.

REGO REGO REGO REGO

REGO LEADER

REGO GM

Work

ht 32 oz.

REGO GM

REGO model GM gooseneck torch is a light weight, general welding torch for all work up to 3 in. in thickness. Its assortment of two extensions, 6 inches and 12 inches long and 9 tips make it adaptable to all welding conditions.

Leak Proof

REGO GM has only one joint from butt to tip, thus effectively eliminating any chance of gas leakage. The mixing chamber is drilled as a part of the extension. No small loose parts to become damaged or lost. No possibility of damaging the mixing chamber through careless handling, causing poor mixture and leaks.

Safe

The objectionable and sometimes dangerous feature of mixing the gases in the handle has been removed. Note that the mixing chamber is located some distance in front of the handle.

REGO method of gas mixture—universally recognized as the only method of obtaining a perfect neutral and economical flame—insures No Flashback.

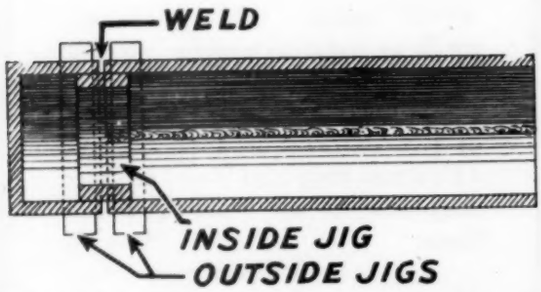
Prices

GM Torch only—12" long, no extensions or tips	$15.00
6" extension only, for light work up to 1"	5.00
GM nickel copper tips, for use with 6" extension, each	1.50
12" extension only, for work up to 3"	7.50
GL nickel copper tips for use with 12" extension	1.75
GM torch with 6" extension and 6GM tips	27.50
GM Torch with 12" extension and 3 GL tips	26.25
GM torch with 6" and 12" extensions, 6 GM tips and 3 GL tips	40.00

The Bastian-Blessing Co.
246 E. Ontario St., Chicago, Ill.

This flux is powdered, mixed and applied in a shellac solution (containing ½ lb. shellac to 1 gal. of alcohol), either by brush or by dipping, both to the rod and to the edges to be welded.

In some cases the use of a flux will cause readier flow of the metal, particularly in the case of welding Nickel.



Circular Weld in Light Gauge Sheet; Ring Jigs Inside and Out, Firmly Clamping the Work.

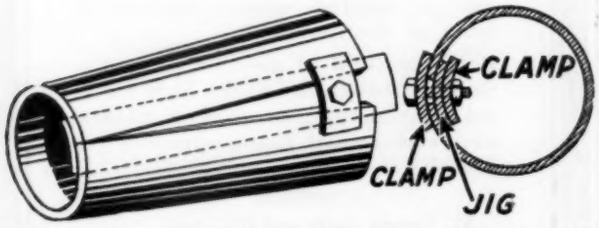
The welding of thin sheet Monel Metal should be carried out as uniformly and rapidly as possible, in order to avoid burning it too deeply.

Metallic-Arc Welding

The principal features of the metallic-arc welding of Monel Metal that differ from steel practice are two: (1) A deoxidiser coating should be applied to the bright Monel Metal welding rod and 2) the work should be made negative instead of positive as in steel practice.

The latter feature indicates that better results are obtained with D. C. welding of Monel Metal than with A. C. arc-welding. When the work is made positive the metal of the electrode does not flow freely and continuously but tends to drop off.

The special "deoxidiser coating" which is recommended, consists of the grade No. 2 silicon-manganese-magnesium alloy sold by the Elecro Metallurgical Corporation at 30 East 42nd Street, New York City. This contains



Longitudinal Weld On Cylinder For Heavy Gauge Sheet (Over .062"); Note Method of Clamping.

Magnesium	14 to 16 per cent.
Manganese	27 to 33 per cent.
Silicon	45 to 50 per cent.

It is brittle and can easily be ground and powdered, although it is somewhat inflammable in dust form and care should be observed in handling it.

This alloy is ground to about 50-100 mesh and suspended in a shellac solution (½ lb. shellac to 1 gal. alcohol) to give an oily consistency which will still run. The welding rods of Monel Metal are dipped in this suspension and allowed to dry with the powdered coating. This should average about 2 per cent by weight of the welding wire; thus a $\frac{5}{32}$ wire will require about a pound of deoxidiser to 600 ft. of wire. After drying the coating adheres and the rods will stand handling and transportation.

Monel Metal rods already coated in this manner can be obtained from Welding Service Corporation at 30 Church Street, New York City.

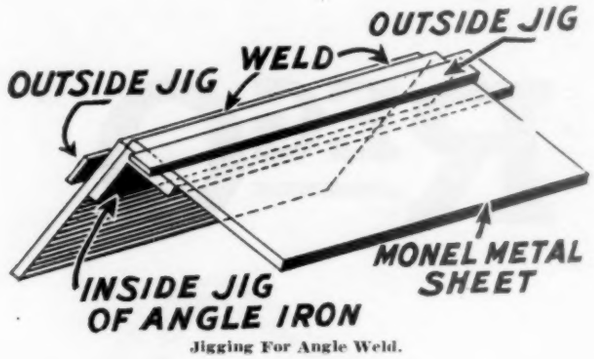
Any of the D. C. welding machines now on the market are satisfactory for the arc-welding of Monel Metal.

Carbon-Arc Welding

The practice for carbon-arc welding of Monel Metal is exactly the same as for steel except that a Monel Metal filler rod coated with the deoxidiser noted above gives better results than a bright wire.

Which Method to Use

Generally speaking, heavy work can most economically be done by the metallic-arc method, although either oxy-acetylene or carbon-arc may be used quite successfully.

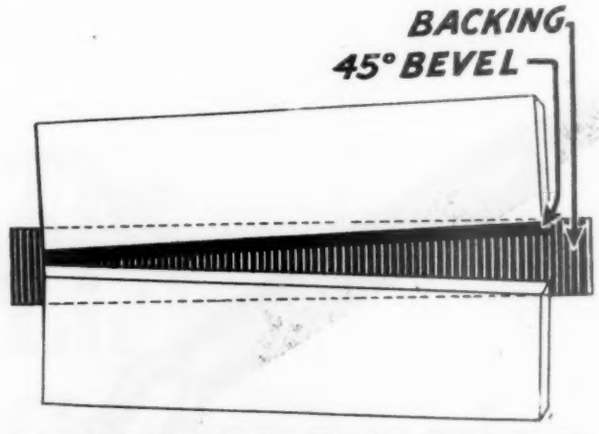


Jigging For Angle Weld.

For light sheet work the oxy-acetylene method is recommended as being the most reliable, although good results can be obtained with the carbon-arc. The metallic-arc method should not be used on sheets under 14 gauge. In welding sheet under $\frac{1}{16}$" it is best to flange the edges and use no filler rod.

Welding Rod Sizes

Monel Metal or Nickel welding rod sizes correspond exactly to steel practice.



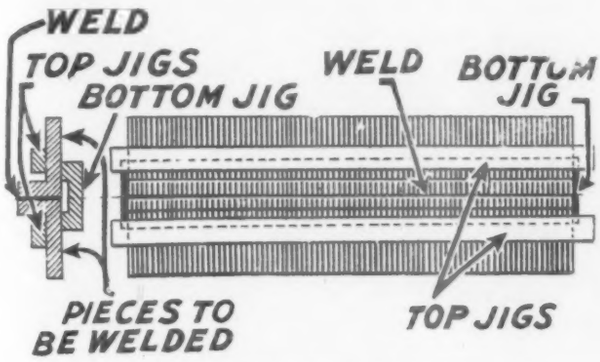
Jigging For Butt Weld in Heavy Gauge Sheet; No Top Jig Required; Note 45° Bevel.

	Current	Work	Welding Rod
		$\frac{1}{16}$" and under	No rod
Oxy-Acetylene and Carbon Arc Welding		$\frac{1}{16}$"-$\frac{1}{8}$"	$\frac{3}{32}$"
		$\frac{1}{8}$"-$\frac{1}{4}$"	$\frac{1}{8}$"
		$\frac{1}{4}$"	$\frac{5}{32}$"
Metallic-Arc Welding	125-150	$\frac{1}{8}$"-$\frac{1}{4}$"	$\frac{1}{8}$"
	150-200	$\frac{1}{4}$" up	$\frac{5}{32}$"

Spot Welding Monel Metal

Monel Metal may be successfully spot welded on the machines put out by the Thomson Electric Welding Co., Lynn, Mass. In spot welding care must be taken that the pressure is on the metal before the current is passed through the work. Should there be an air gap between the metal and the electrode of the machine, the material will not be welded through out but merely stuck together and can be broken very easily. The work must be done very quickly. It requires about half the time and twice the current to spot-weld Monel Metal that is required for steel of the same thickness. Successive spot welds on the same pieces will require more current than the first weld due to a complete circuit having been formed.

We give below data obtained in some experiments on Thomson Spot Welding machine, Model 130 K.W. 10, volts 220, cycles 60:—Handle on No. 2, 1¾ volts between electrodes for ⅛" and ⅛" Monel Metal Wire. Handle on No. 3, 2 volts between electrodes for ⅛" and ¼" Monel Metal wire.



Light Gauge Flange Weld; Note Recessed Bottom Jig.

Butt Welding Monel Metal

The Thomson butt welding machines are entirely suitable for Monel Metal. The butt welding of Monel Metal is somewhat different from steel. The requirements which a welder must fulfill to do this work are uninterrupted movement of the movable platen, as well as quick movement at the end of the weld, accompanied at the same time by heavy pressure. These requirements are met by using the Thomson No. 10A and No. 20A machines. A steady, continuous flash must occur while the metal is being heated up to the welding temperature, and after it has reached this temperature, a quick free moving pressure must be applied to push the hot pieces together.

The following are data obtained from experiments with the Thomson but welding machines:

Model 10A, 220 volts, 60 cycle, 114 amperes. Handle on No. 2, 2¼ volts between dies for ⅛" Monel Metal Wire. Handle on No. 3, 2¾ volts between dies for ¼" Monel Metal Wire.

Model 20A, 220 volts, 60 cycle, 230 amperes. Handle on No. 5, 4⅞ volts between dies for ¾" Monel Metal Rod.

Seam Welding Monel Metal

Monel Metal sheets may be successfully welded on the Thomson machine No. 324. Their machines Nos. 306, 312 or 318 may also be used, the only difference being the throat length. The longest strip that could be welded with machines would be 24". The material requires considerable current and light pressure.

In spot, butt and seam welding, the metal must be perfectly clean. The current required is about twice as much as that required for steel of the same size.

Monel Metal Rods for Welding Cast Iron

Monel Metal makes an ideal welding metal for work in cast iron. It penetrates the cast iron and produces a homogeneous weld, at the same time producing a weld soft enough for machining. Monel Metal wire is extensively used for this purpose. A special coated wire, for use in metallic arc welding, is produced by The Wilson Welder & Metals Co., New York City.

E. H. SMITH WELDS WITH ACETYLENE ICE

The current issue of *Smithograms*, monthly publication of Smith's Inventions, Inc., Minneapolis, Minn., prophesied the coming of a new era in welding; an era in which it will be unnecessary to keep track of gas cylinders and pay the transportation charges on them. This prophecy is based on a recent performance of E. H. Smith, president of the company, which is described as follows:

"In a demonstration conducted before the members of the Mechanics' Mutual Benefit Association of South Dakota at their annual banquet on February 13th, Mr. Elmer H. Smith operated a welding torch using neither tanks nor a generator to supply the necessary gas. The acetylene was furnished by a cake of acetylene ice, which, in melting, gave off acetylene gas. Acetylene ice has a temperature of 160° F. below zero and is made by freezing pure acetylene gas by means of liquid oxygen. Liquid oxygen was used to supply the oxygen. Liquid oxygen has a temperature of 300° F. below zero and when allowed to evaporate, gives off pure oxygen gas. Thus from two substances having almost the coldest known temperatures, one of the hottest temperatures is obtained, that of the welding flame.

Old Dad Hangs Out The "Ice Sign"

"To our knowledge, this is the first time that a welding torch has been operated from acetylene ice and liquid oxygen, and the possibilities that the experiment has opened up are tremendous. When the idea is placed on a commercial, working basis, the acetylene and liquid oxygen will be placed in containers and by automatic damper arrangements, air will be allowed to circulate in contact with them to deliver the necessary heat to change the liquid and ice to gas. If this is ever done, Elmer Smith's experiment should be as much of an epoch in the history of welding as the advent of the self-starter to the automobile industry (in the eyes of the Bendix people). As a liberator of the cylinder service slaves, Mr. Smith should be hailed as another Lincoln. Can't you see the happy expression of freedom in every welder's eyes as he joyfully hangs out a sign calling for 5 lbs. of acetylene ice and 2 qts. of liquid oxygen meanwhile mentally thumbing his nose at his one-time tyrant, the drayman? Some day, some happy day, and may it be close to hand."

A. W. S. TRAINING COURSE IN BULLETIN FORM

The report of the Committee on Training of Operators of the American Welding Society, 33 W. 39th St., New York, has been published in the form of a separate bulletin. The report deals with the training of oxy-acetylene welders. A general survey is given of the amount of information needed by the student welder, then a series of exercises covering the complete course of training is supplied. The exercises are grouped in "blocks" for the convenience of the instructors, who may have different requirements to meet. It is understood that a similar bulletin on the training of arc welders will soon be issued.

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VOLUME 9 MARCH, 1924 NUMBER 3

CONTENTS

Production Brazing.....19
Welding Stellite with the Oxy-Acetyline Torch.....21
Jobs for Men and Men for Jobs.....22
Precision Welding.....23
Welding Monel Metal and Nickel.....25
Editorials.....30
Rules for Safe Handling of Cylinders.....32
Hints for Welders.....33
Welding Torch Reconstructs Gas Holder.....36
Steel Welding Contest.....38
Letters from France.....40
News of the Welding Trade.....46
Current Welding Literature.....48

Thoroughness in Demonstration

ONE of the exhibits at the Eighth International Acetylene Congress which was recently held in Paris consisted of a demonstration of cutting under water. Under water cutting is not a particularly new idea, and it was not intended to create such an impression. Its purpose of the demonstration was to introduce a new form of cutting torch made expressly for this work.

There are two very note-worthy features of the exhibit. One is the fact that it attracted the attention of practically every visitor at the exposition. The other is the wonderful thoroughness with which the stage was set. No detail was omitted which could have contributed to the success of the exhibit. Cutting a few wire nails in a bucket of water was not enough for these Frenchmen. They set out to put out a real show, and they did it. An all-welded tank large enough to hold a complete exhibit and high enough so that the operator could be seen by people standing around in front of the booth was specially constructed for this show. A huge piece of plate glass, weighing four hundred pounds, was specially made to serve as a window. The tank was filled with water, and arrangements were made to use running water so that it would at all times be clear. An experienced professional diver who is considered to be able to remain under water for four minutes without breathing was engaged as a demonstrator. He was also supplied with a special mask instead of the regulation diver's helmet. Before each demonstration a short lecture on the Oxy-Acetylene Process was given to the crowd. Then Mr. Diver proceeded to submerge and do some honest-to-goodness cutting on large steel sections. This is probably the best demonstration of the oxy-acetylene process which has been made for an exposition of this sort. The ingenious proprietors who arranged it ought to be congratulated not only on its success, but also upon its thoroughness.

Standardizing Good Welding Practice

ONE of our largest railroad systems has found a very effective method of making sure that the best procedure on all welding jobs will be followed in all their repair shops. One official has interested himself in the compilation of a complete manual covering both gas and electric welding. After giving a brief but very instructive introduction to each of these processes and outlining the limiations of each process as indicated by existing railroad regulations, the manual proceeds to furnish definite specifications for a large number of the most common welding jobs. For each job there is a separate instruction sheet, and a separate drawing of the piece to be welded. An especially interesting feature of the manual is that it is issued in blue-print form. Each copy is numbered and a receipt is taken for it and record made of its location. Now, whenever experience shows that it is advisable to change the instruction for a particular job, new instructions and new drawings are prepared, and enough copies made to replace the old instructions in the existing manuals. A careful record kept of the disposition of the manuals makes it possible to supply each man who is using one with the new instruction material just as soon as it is issued, and collect from him the old instruction sheets, which are destroyed.

It is quite an expensive and difficult undertaking to get a manual of this sort into the hands of every welder on the system, but just as soon as it is in use, the official who is responsible for good results from welding equipment knows that any information regarding improved procedure can be made instantly available to every welder in his employ. In other words the best practice for a particular job immediately becomes standard practice.

Welding Apparatus is Not Defective

A MANUFACTURER rises to protest against the use of the word "defective" as applied to all kinds of welding apparatus, and his point is very well taken. For a number of years manufacturing processes in this industry have been consistently improving and the makers of standard lines of apparatus under

From a ship builder—

"I cannot let this pass without commendation

"YOUR special trip at an inconvenient time meant an important repair job completed without delay.

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stress of competition as well as from a sense of pride in their product take exceeding pains to make sure that defective goods are not shipped. Torches, regulators, welding hose, gauges, motor generators, electrode holders, helmets, goggles, etc., are all carefully inspected before leaving the factory. After delivery they are subjected to all sorts of conditions ranging from simple neglect to absolute abuse. A length of welding hose left hung over a nail in the welding shop for a few years will be unfit for service, but not defective. A motor generator set left standing uncovered in a dirty blacksmith's shop may be nearly ruined by this exposure, but it is not defective. The trade needs a word which will describe such equipment without carrying the inference that its faulty performance is due to inefficiency or neglect on the part of the manufacturer.

RULES FOR SAFE HANDLING OF CYLINDERS

(Compiled by Gas Products Association)

Oxygen

1. Compressed oxygen plus oil is explosive. Allow no oil or grease of any kind to come in contact with valve, regulator or any other portion of the cylinder or apparatus.

2. When shipping empty oxygen cylinders to manufacturer, lower portion of green tag attached to cylinders should be removed at the perforated line. Any green sticker label found pasted to the cylinder should be removed. Bill of lading should specify that the cylinders are empty and serial numbers of the cylinders should be noted thereon.

3. Cylinders of oxygen, except those in actual use and in excess of approximately one day's supply required in any one department or point about the shop, should be stored in a place where they will not be tampered with by unauthorized persons.

4. Oxygen cylinders should be stored in a safe, dry place, where they will not be exposed to the heat of stoves, radiators, furnaces, or in the direct rays of the sun. Heat will increase the pressure and it may cause the safety plug or disk to melt or blow, thus allowing oxygen to escape, resulting in waste. If the escaping oxygen comes in contact with even the smallest flame it has such a tremendous influence upon combustion that a quick raging fire is liable to result.

5. Cylinders of oxygen are never to be stored in the same room used for the storage of calcium carbide, cylinders of dissolved acetylene or other fuel gases, or with acetylene generators.

6. Open flames of any description shall not be employed in any building used for the storage of oxygen cylinders.

7. If cylinders are stored on the ground or open platforms, such locations should not be adjacent to points where there is a large amount of combustible material.

NOTE.—While oxygen itself will not burn, its effect in aiding combustion, once a blaze is started, makes it important that rules 4 to 7 inclusive be carefully observed.

Acetylene, Hydrogen, Etc.

1. When cylinders of dissolved acetylene, hydrogen, liquid fuel gases or vapors are not in use, outlet valves shall be kept tightly closed, even though cylinders may be considered empty, and valve caps replaced.

2. Cylinders should be stored in a safe, dry, well-ventilated place where they will not be unduly exposed to the heat of stoves, radiators, furnaces, or the direct rays of the sun. Heat will increase the pressure, or it may melt the fusible safety plug with which most cylinders are provided and which melts at a temperature of approximately 212 to 220 degrees F.

3. No open flame, grinding tools, or spark-emitting devices shall ever be used within the storage building or compartment, and all artificial lights shall be incandescent electric and shall be installed in accordance with the "National Electrical Code for Rooms in Which Inflammable Vapors May Exist."

Electric light switches, telephone and all other apparatus which may cause a spark must be located on the outside of building.

All lamps shall be enclosed in vapor-proof globes of the Marine type.

4. Cylinders of dissolved acetylene shall always be stored standing upright with valve end up.

5. When shipping empty dissolved acetylene cylinders and other fuel gas cylinders to manufacturers, lower portion of red shipping tag attached to cylinders should be removed at the perforated line. Any red sticker label found pasted to cylinder wall should also be removed. Bill of lading should specify that the cylinders are empty, enumerating the type and individual numbers of such cylinders.

6. Under no circumstances attempt to transfer acetylene from one cylinder to another, and never under any conditions attempt to compress acetylene into a cylinder. This work should only be performed by acetylene charging plants, and under conditions which comply with Interstate Commerce Commission regulations.

General

1. Oxygen cylinders and acetylene, hydrogen or other fuel gas cylinders shall not be transported or lifted by crane or derrick except when they are in a cradle or substantial stand, and cylinders shall never be handled with electro-magnets or with rope or chain slings.

2. Cylinders should be handled carefully, should never be dropped, and should be placed so they will not fall nor be struck by other objects. Knocks, falls, or rough handling are liable to damage the cylinder, valve or fuse plugs, and cause leakage, and may even result in an explosion.

3. When exhausted cylinders shall be returned as rapidly as practicable to the storage building or place, and from there to the manufacturer. Empty cylinders should be marked "EMPTY" and stored apart from full cylinders to prevent confusion. Valve protection caps must be replaced.

NEW MILBURN CUTTING TORCH TIPS

An interesting development in oxy-acetylene cutting apparatus has been recently perfected by the Alexander Milburn Company, Baltimore, Md.

This is the perfection of what has been called the "Super Tip" for cutting, which, while embodying all the desirable features of the standard tip, has additional features which mark it as a signal improvement.

The distinctive features of this tip are a method of extra mixing of the gases and preheating the cutting oxygen as well as giving added velocity and penetration to the preheating and cutting jets. A further feature is that the tip is provided with a renewable seat at a fraction of the cost of a complete tip, rendering it unnecessary to re-machine or discard the used tips. This renewable seat facilitates the cleaning and maintenance of the tip. In the standard tip the seat could be refaced by taking a thin cut off of it in a high speed lathe, but if the lathe is not available the seat cannot as readily be refaced.

The new tip retains all the features of the tip which has been standard on Milburn torches for a number of years, with the added advantages noted above. The mixture of the preheating gases takes place in multiple passages in the renewable seat. These gases then pass into an annular passage where they are given a swirling motion and an additional mixing. The gases are again separated and expanded into enlarged multiple passages leading to the orifices in the tip proper. Here the preheating flames are projected with an increased velocity inclined toward the high pressure oxygen jet which the makers claim results in a speedier cut, a narrower kerf and a material saving in gases.

The new tip with renewable seat is interchangeable with all sizes of Milburn cutting tips and will fit all this company's torches manufactured since 1916.

Hints for the Welder

When you finish an interesting piece of work, can you set down on paper the manner in which you went about the job, how you prepared the work and how the job was done? Have you learned some little stunt every welder ought to know? Contributions to this department are paid for. Write it down any old way – I'll polish it up. Make a rough pencil sketch and our draughtsman will fix it up fine. Line drawings are more practical than photographs. Do it today – the men on the firing line are waiting. L. B. Mackenzie, Editor.

WELDING NO. 20 GAUGE BLACK STEEL METAL SHEET WITH 1/8" DIAMETER ELECTRODE

Editor:—

My recent experience in arc welding No. 20 gauge steel sheet using 100 amperes and a 1/8 inch diameter mild steel electrode may be of interest to your readers.

We all know it is possible to weld light gauge metal by using a good backing-up material, such as copper, and a welder that will give us low heat values, such as 25 to 60 amperes, and electrodes of 1/16 inch and 3/32 inch diameters.

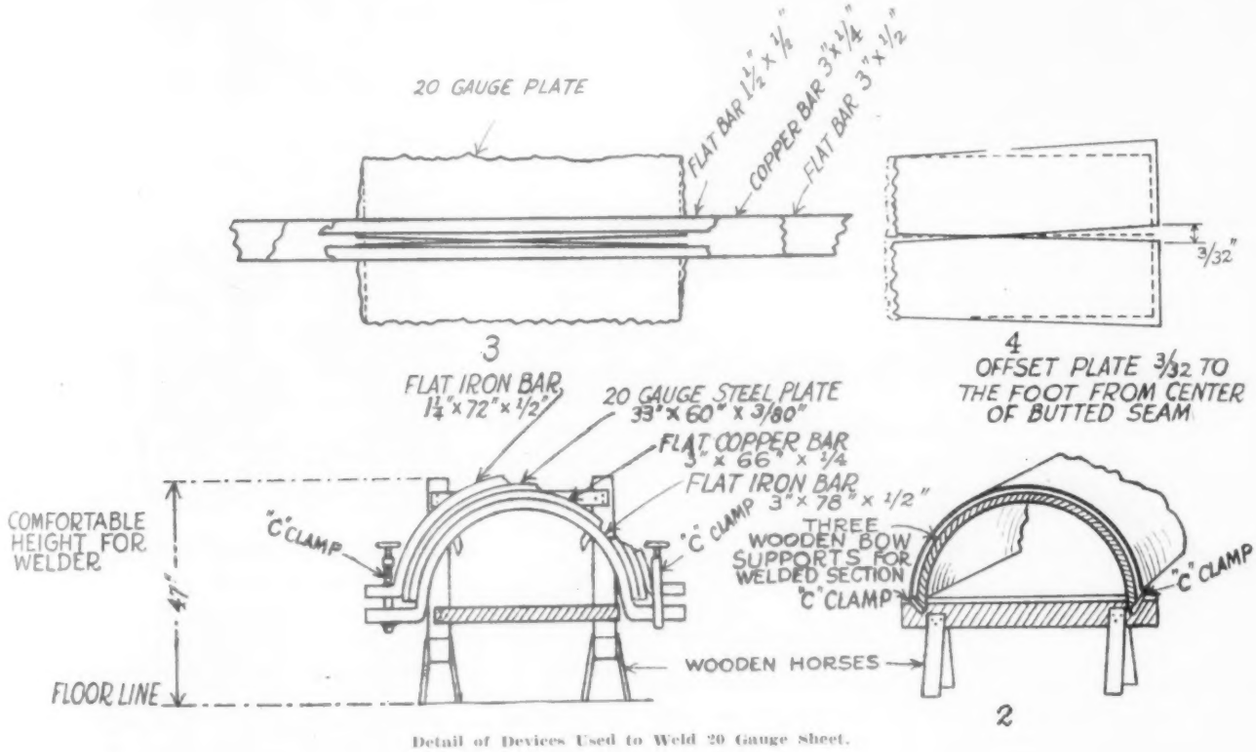
The difficult problem is where we have the standard heat regulated arc welder, 100 to 200 amperes, and are required to make welds on this same light gauge metal.

There were ten sheets with sizes as follows:

6—60x33 inches
2—60x22 inches
2—60x16 inches

rolled to a given radius, to be welded together for a top and bottom section of five sheets each. I first had a jig made, having the same radius as the rolled sheets. The jig consisted of one flat iron bar 3x78x½ inches with feet flanged out on both ends for clamping purposes. This bar also supported a flat copper bar 3x66x¼ inches, which was the backing-up material for the plates. In addition to this, there were two flat iron bars 1¼x72x½ inches, with flanged feet, used as clamps to hold metal tight against the copper backing. "C" clamps were used to draw the flat bar clamps down to the bottom flat bar. This jig was mounted loosely on two wooden horses which permitted it to be turned 90 deg. in either direction. See Figure 1.

Figure 2 shows the next step, setting up three wooden forms to hold the sections as they were welded, so as not to have the weight of these sections affect the sheets at the point where



Detail of Devices Used to Weld 20 Gauge Sheet.

the new welds were being made, and also to facilitate lining up the seams before welding. These forms were wooden bows made to the same radius as the rolled sheet and fastened at the ends to a wooden horse with "C" clamps. As these bows had to be adjusted from time to time, it was found that "C" clamps were better fitted than attaching the bows permanently and shimming between the sheets and the bow.

The sheets were butted together in the center of the seam and separation allowance of 3/32 inch to the foot from center to outside edge of sheet in both directions, shown in Figure 3, and in detail in Figure 4. The welding procedure was from the center to the outside edge of seam.

The welding was done with an A. C. Transformer type of welder, with lowest heat regulation of about 100 amperes. By using a 1/8 inch diameter electrode, we could lower the heat in work (plate) as this larger size electrode absorbed the greater part of the heat. We can readily see this when we look back

at our normal welding practice on ¾ inch plate, where it takes from 175 to 200 amperes to make good welds when a ⅛ inch diameter electrode is used.

This job when completed had four seams each 6 feet long on both top and bottom sections, as shown in Figure No. —, making a total of 48 feet of welded seam with only a very

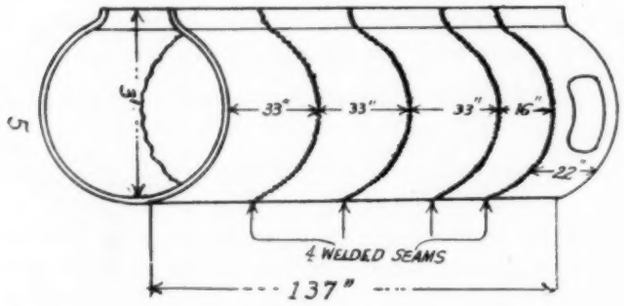


Figure 5.

slight buckle showing here and there, which we were able to straighten out after we had the weld ground to a flush surface.

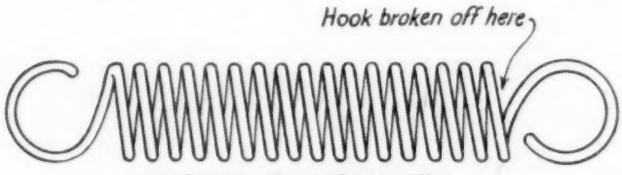
Chas. M. Rusk.

REPAIR OF BROKEN SPRING

By George Reed

Out here in the wilderness we have a huge oil engine which is operating under a very fluctuating load; probably from a light load to a peak load and the reverse all within a few minutes. Its duty is to operate a stone crusher, and the variation of the size of the rock going through causes the above variation in load.

To take care of such conditions the governor on this engine is necessarily very sensitive. It consists of two ½-inch coil springs about a foot long and two balance weights. I had the job of repairing one of these springs which had broken near the end as shown in the sketch. The spring



Coil Spring Repaired by Welding.

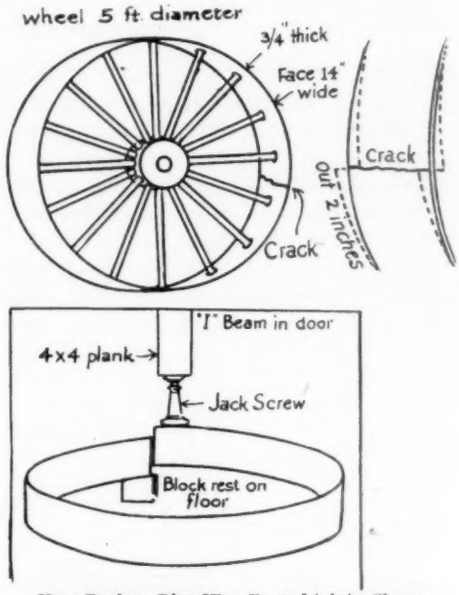
of course was made of special alloyed steel and specially tempered. If this had been the ordinary steel spring, we would not have hesitated to hand it over to the blacksmith to repair, but as the temper was not known, and the rock crusher and a crew of men were waiting, something had to be done right away. An unsuccessful experiment would have proven costly here because it would take a long time to get a replacement.

Our welding department undertook to make the repair and proceeded as follows: After grinding the unevenness from the broken end, we set the whole spring upright in a vessel of water just leaving the top ring exposed. Between this top ring and the water we inserted pieces of asbestos fibre board and luted it with fire clay. We put the torch on the top ring and brought it to a bright red heat. Then one man held the spring while another man took hold of the heated ring and bent it directly upright, thus making a real good hook. This work had to be done quickly to prevent the temper from being drawn from the rest of the spring. It was then put back in water and left to cool. The fact that the temper was taken out of the hook has not appeared to injure the spring. It was put back in service and seventeen men were back on the job within less than two hours from the time it broke.

WELDING A STEEL TRACTOR WHEEL

By C. M. Johnson

A short time ago I handled quite a difficult welding job which may offer some useful suggestions to other welders. This was a large steel tractor wheel which had a crack running across the rim. To make it more difficult it was at least 2 inches out of line. The proposition of getting the whole wheel back into proper shape puzzled me for a while. Finally I took a screw jack and some 4x4 planks and rigged it up in the door-way as shown in the



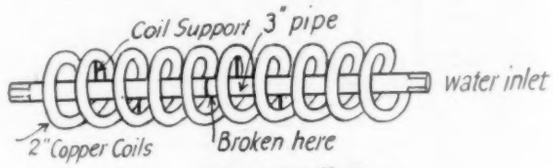
How Broken Rim Was Brought into Shape.

sketch. The door has a 12-inch I-beam running across the front so I put the block on one side of the rim, my jack and a 4x4 on top on the opposite side, and commenced screwing up on the jack. I was surprised to find out how much pressure I could put on this. It pulled down to place nicely. Then I made a straight weld on both sides after veeing it out with a cutting torch. I let it cool right in place and when I removed it the wheel was just as straight as it was before the break occurred.

WELDING A COPPER WORM

By W. F. Beach

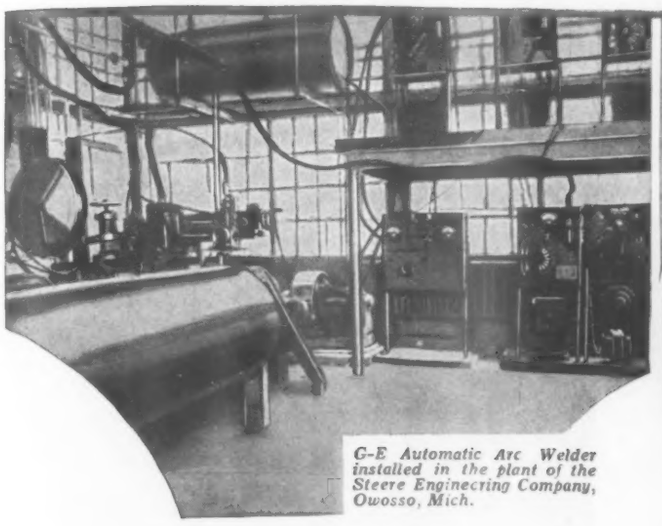
A short time ago we had occasion to weld a large copper worm, part of a cooling vat, which had been broken in the middle. It consisted of a piece of copper tubing 2 inches in diameter, formed into a coil 3 inches in diameter, 15 ft. long. It was fastened to an arbor made of 3 inch copper pipe, 15½ ft. long; and the tube itself was only about ¼-inch thick and weighed approximately five hundred pounds. Since the original cost of the coil was about $900.00, it meant quite a sav-



Broken Copper Worm.

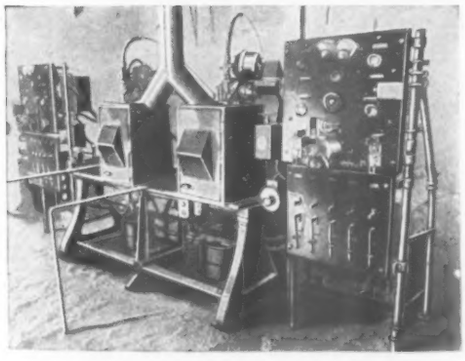
ing if it could be successfully repaired by welding. We took the coil from the vat and pulled the break together by using 2⅜-inch cold rolled steel rods 15 ft. long, having the ends threaded. Two light steel plates were placed along the ends of the coil; then the nuts were applied on the ends of the threaded rod. When they were tightened up the 3-inch pipe in the middle of the coil came back to position. This was brazed with tobin bronze. Then the coil was mounted

Why the Automatic Arc Welder?

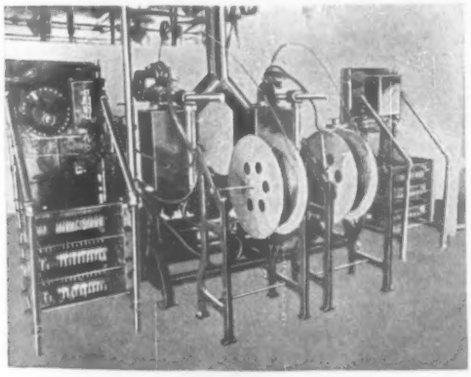


G-E Automatic Arc Welder installed in the plant of the Steere Engineering Company, Owosso, Mich.

At the plant of the Otto U. Hoffman Company, Philadelphia, Pa., a G-E Automatic Arc Welder is used for the welding of stocking forms.



G-E Automatic Arc Welders used in the Lowell plant of the Saco Lowell shops, largest manufacturers of textile machinery in the world.



Because of These Advantages

1. The replacement of hand labor, limited by physical conditions, with a machine *built for exacting service.*

2. The even deposit of the electrode metal, minimizing defects—and producing a more *uniform weld of better quality.*

3. Automatically maintains a constant arc length which results in steady operation—and a *faster deposition of metal.*

4. The use of continuous feed of electrode wire eliminates cold spots, *saves time and material.*

5. More speed—2 to 5 times faster than hand welding —*increases production.*

6. In all operations—*greater economy.*

A G-E welding engineer will gladly assist you in working out the best uses of automatic arc welding in your plant.

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GENERAL ELECTRIC

on two wooden V blocks. The braze was heated to nearly a red heat and with a block of wood and a hammer the 3-inch pipe was easily sprung so that the coils ran true. This was the important part of the work because the coils were filled with cold water and are used for cooling cream. If it did not

Jig for Trueing up Coil.

run true it would break under its great load of water and ruin a great quantity of the cream. The repair which we made here was perfectly satisfactory and the cost of making it was only about $20.00.

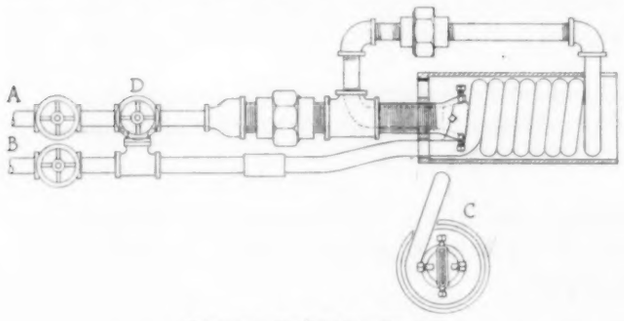
SPECIAL PRE-HEATING BURNER

Designed for using either kerosene or fuel oil, a pre-heating torch has just been made by F. L. Martin of Houston, Texas. He has the apparatus in use in his machine shop at 702 North San Jacinto street.

The burner is fashioned after types used for fuel oil burning. The opening is adjustable, however, making it possible to burn different classes of liquid fuel. Pressure is furnished from a compressor, and intense heat is possible. The burner is used for heating previous to welding, for thermit welding and for annealing purposes.

The fuel line is shown as A in the illustration. The fuel is diverted behind the mouth of the burner, as the three-eighth inch pipe shows to the left. It passes to the front of the burner, where the coil starts. As the kerosene or oil passes backward through this coil, it is transformed into gas by heat.

When it issues from the mouth of the device, a cross section



Kerosene Preheating Burner.

of which is shown as C, it is under the pressure of the air from the line B.

Both fuel and air are controlled by cocks behind the by-pass D. By regulating these cocks the heat can be fixed at the required temperature and the process is instantaneous.

The by-pass is for cleaning carbon from the burner. After the fuel is shut off and before that remaining in the burner has had time to cool, air is turned through the by-pass to remove carbon.

Screws shown around the mouth of the burner in the cross section C are for adjusting the outlet for whatever type of fuel is desired. For heating previous to welding kerosene is used as fuel.

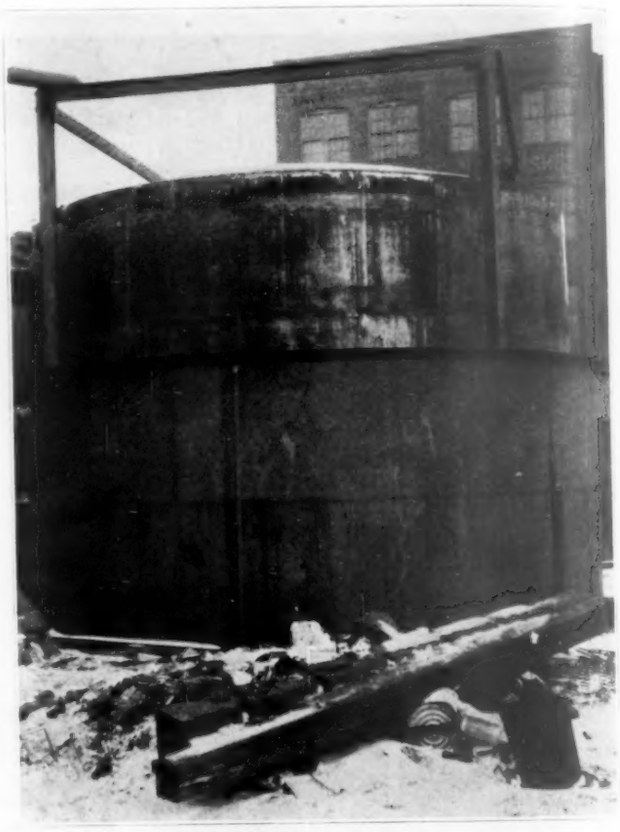
The coil is inclosed in a metal guard, three inches in diameter. This makes it possible to apply the heat to a limited area.

The torch is portable, when both lines are attached to hose, one running from the compressor, another from the fuel tank, the fuel flowing by gravity. Metal is used for a section of each line for sufficient length to make handling easy.

Something of the heat possible from the apparatus can be learned from the fact that a recent welding job in the shop required the heating of a 17-ton wobbler from a mill. This burner with two small ones brought sufficient heat in a few hours.

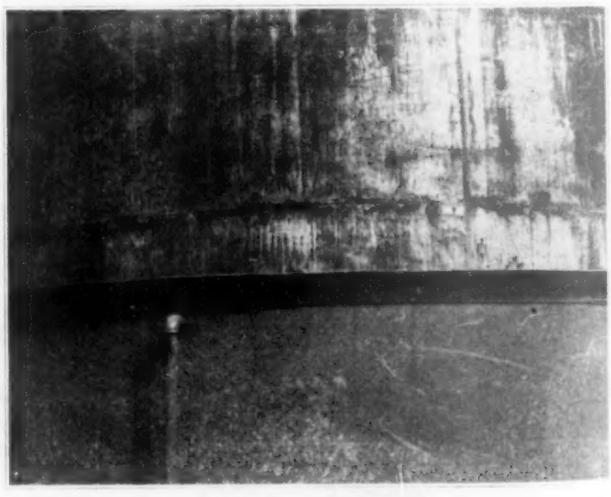
WELDING TORCH RECONSTRUCTS GAS HOLDER

The welding of a large Gas Holder in Cleveland furnishes an interesting example of the use of the oxy-acetylene torch in



Gas Bell Repaired by Oxy-Acetylene Welding.

reclamation work. The Gas Holder is the property of the Burdett Oxygen Company, of Cleveland. When it became necessary to replace the side sheets of the old bell, the welding torch came to the rescue and performed a perfectly satisfactory repair in



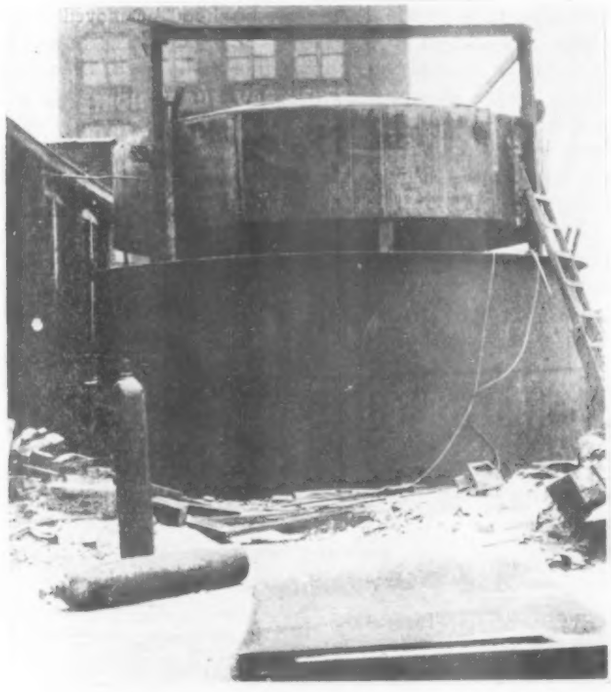
Welded Seams in Gas Bell.

spite of adverse weather conditions. Mr. H. E. Winkelman, Service Engineer of The Purox Company in reporting this job calls attention to the fact that the work was done under very trying conditions, as the thermometer registered below zero during practically the entire job. In fact the photographs of the work reproduced here show that there was a good bit of snow falling.

The first operation in making this repair was to cut away the side sheets of the old bell from the head. This left the angle iron support completely intact which assisted in forming the new

Welding First Row of Sheets.

sheets. The head was raised on blocks and new sheets were bolted to the angle. The first weld was horizontal, joining the sheet to the angle and overlapping the angle to compensate for the rivet holes from the old sheets. (See Fig. 1).



Ready for the Second Row of Sheets.

After the first row of sheets had been welded in place the subcurb was bolted to the bottom of the sheets with the vertical seam coming in the center of the curb as shown in Fig. 2. The seam was wedged apart at the bottom and the weld made from the top downward.

Then the second row of sheets was bolted to a subcurb before being placed in position. They were held to the subcurb at the bottom of the first row of sheets by bolts through the lip of the angle forming a subcurb. The cross section view at the left in Fig. 3 illustrates how the second row of sheets was held in place.

A continuous back hand weld was used on all seams and no

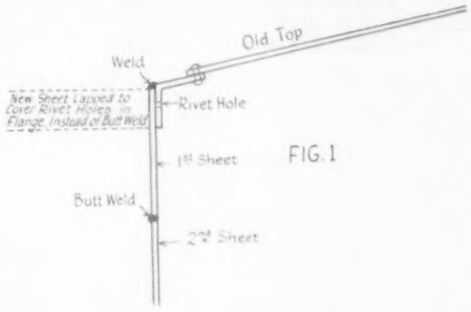


FIG. 1

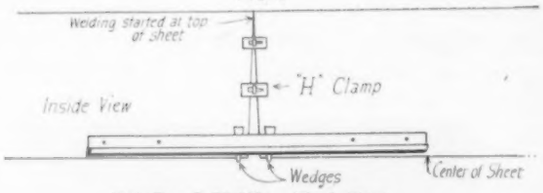
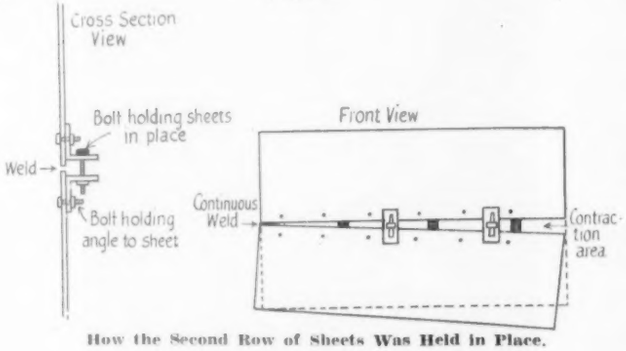


FIG. 2

Details of Welding First Row.

buckling was encountered on the entire job. It was found necessary to allow a little more for contraction than is usual in making such welds under moderate conditions because in this case the welders were working in extremely cold weather.

FIG. 3



How the Second Row of Sheets Was Held in Place.

The principal difficulty was encountered while attempting to put the first row of sheets in place. This difficulty was due to the fact that the old top of the bell was very flexible, and the only way to overcome it was to do considerable bracing.

SUMMER SESSION OF CARNEGIE TECH

Of special interest to our readers is the wide range of engineering courses that will be given this year at the Summer Session of the Carnegie Institute of Technology. The summer work, which will cover both theoretical class room instruction and shop practice, is outlined, according to an announcement, to be of special benefit to undergraduates and to those engaged in engineering work who feel a need for more technical training in their respective fields. Courses of six and eight weeks will be given, beginning June 16.

The College of Engineering will give courses in Chemistry, Physics, Mechanics, Engineering Drawing, Descriptive Geometry, and Surveying. A special short course in Coal Mining will be given in co-operation with the U. S. Bureau of Mines.

In the College of Industries courses are scheduled in Plumbing, Welding, Mechanical Drafting, Sheet Metal Work, Patternmaking, Machine Shop, Woodworking, Cabinetmaking, Electricity, Radio Communication, and Drafting. Subjects in general studies will include English, Economics, Mathematics, Psychology, and Commercial Law.

Californian Wins Steel Welding Contest

Welding Contest Discloses That Lack of Penetration and Poor Fusion Continue to Be Principal Faults

THE Steel Welding Contest announced in November, 1923, by the United States Welding Company, of Minneapolis, Minn., came to a close on March 1st. The $100.00 prize to be given the welder making the best steel weld has already been awarded to E. R. Nash, of Hanford, Calif.

The object of the contest, as announced at the outset, was primarily to show as many welders as possible the exact status of their work. For this reason one of the conditions of the contest was that each weld must be broken through the weld before entering it in the contest. It was felt that those operators who found lack of penetration through the entire thickness of their metal, would instantly recognize this

E. R. Nash, Winner of Welding Prize.

fault and thereafter penetrate still deeper, thereby improving their own work, and incidentally, the industry as a whole.

The results were very gratifying viewed from the number participating, but from another angle it would indicate that there is much yet to be done along educational lines by those vitally interested in the industry. The interest aroused by this contest was more than national. Samples were received from foreign countries. Not only were there participants from small job shops, but in many instances large industries had every welder in their employ participate. In addition to the large number of welders participating in this contest, it is felt that there were many who made welds but did not submit them for various reasons.

The welds submitted ought to form a fairly good index as to the ability of the average operator. In judging these welds it was found that the two greatest failures were, lack of penetration and lack of fusion, the former being well illustrated in Figure No. 2, whereas, the latter is brought out very clearly in Figure No. 3, which shows the laminated condition of this particular weld. While these laminations are much more marked in this particular weld than in the majority, yet it shows very decidedly a condition which must be guarded against. It is the intention of those conducting the contest to advise each participant as to the status of his weld and offer suggestions as to how to improve his work.

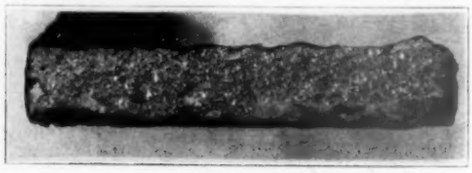
After all is said and done, the human element seems to be the most important thing to consider in the advancement of this great art. The apparatus manufacturers assure us that the apparatus is correct; the gas producers make like claim;

The Prize Winning Weld.

while those companies making filler rods make wonderful claims for their product. Everything points to the human element as the one thing which requires the greatest attention, so it is hoped that those interested will give this important question the consideration it deserves and offer some means for improvement.

Mr. Nash, the winner of this contest, was born in Wallingford, Conn., in 1878. During his boyhood he moved to California, and started to learn the machinist's trade at an early age. After several years of varied experience, he assumed charge of the shop operated in connection with the Imperial Garage at Hanford, Calif. This was in 1908. The establishment is now the Cousins Tractor Company. Mr. Nash gives the following interesting account of his experiences with the oxy-acetylene process:

"During the fall of 1907 I first saw a casting that had been acetylene welded, one Mr. Breck having secured the agency for the Davis-Bournonville products. The process was surrounded with great secrecy, very few ever getting a glimpse of a job in process.



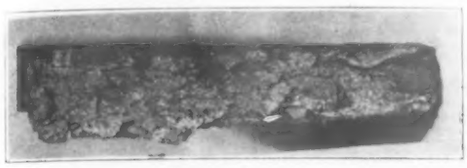
Lack of Penetration.

"I sent several jobs to Mr. Breck, but on the whole I considered them unsatisfactory, due either to hard spots or to warping. I, therefore, concluded that if this was the best the experts could do, it would be wise for me to leave welding alone as long as possible, but in the meantime I read everything I could secure on the subject. Eventually our competitor purchased a torch, so with the information I had gained, I made one.

"My first large job was a cut gear six feet in diameter, broken through the rim, the ends being ¼-inch apart, due as I later learned to strains originally locked up in the casting. I succeeded in preheating the job, drawing the ends together,

and welding the fracture. Much to my chagrin a few days after this job was delivered, I was informed it did only eight hours work and broke in another place.

"After using the home made torch and dissolved acetylene



Poor Fusion.

for a year, I purchased a torch and outfit of popular make including generator, and along with it the much sought privilege of watching a few more or less experienced operators at work in one of our large cities. The rest I have learned by practical experience and reading. I have recently joined the American Welding Society, and hope to continue learning."

Other Contests Have Shown Same Defects

Welding contests serve the purpose of putting a number of welders on their mettle, and proving to a good many of the contestants that their own work will stand considerable improvement. A good many welders are honest enough in their desire to do good work, and just as thoroughly honest in their opinion that they are following the correct procedure. Some of the best Welding Supervisors are acquainted with this condition and make it a practice to test the work of their operators at frequent intervals. This practice has in many cases proven very successful in raising the standard of the work.

About six years ago a steel welding contest was conducted by *The Welding Engineer* along somewhat different lines from the one mentioned above. In the contest conducted by *The Welding Engineer,* numbered steel specimens of uniform size were supplied to each welder so that all welds were made on the same stock. After the weld was made, it was returned without grinding or annealing to *The Welding Engineer* for examination. The first thing done was to examine the specimens carefully with a small magnifying glass and note its general appearance. The piece was next ground off to the same thickness as the original metal and clamped to an anvil with the bottom of the weld at the edge of the anvil and bent over by successive blows of a 12-pound sledge. Care was taken to grind the edges at the point of bending to about 1/16th inch radius to avoid starting a crack at the sharp edge. A number of specimens broke under this treatment before they had reached a right angle bend. Others stood the bending until the two sides were parallel, and the amount of such bending was carefully noted for each sample. Such as did not break under this test were reversed and in every case they broke at the first blow.

An examination of the fracture was carefully made to notice any defects that might exist, and in all cases where the weld was noticeably defective, nothing further was done; the idea being that it was useless to make any further tests of such a weld. In this case an attempt was being made to determine how to make a sound weld, because if welders are to obtain good results this is the first thing they must strive for. If they are successful in this direction, further examination can be made of the qualities of the weld which cannot be determined by the examination of the fracture with a hand glass.

In cases where the welds appeared clean and sound, the examination was carried further by polishing and etching a section and examining it under a microscope. In some cases this disclosed imperfections which should not exist and which detract from the strength of the weld. Photographs were made of all the fractures at full size but they did not show as much as one would like because it is not possible to photograph an irregular surface of this sort and get satisfactory results.

In the case of welds which appeared perfectly sound, enlarged photographs were made of small sections on which etchings brought out quite a number of prominet defects. For example there was considerable indication of oxidation. The microscope also showed small laps which in some cases were numerous enough to seriously affect the strength of a weld on tensile test. It was indicated that these laps were due to not flowing the dirt to the top of the melted metal. The most serious defect noted in the collection of sample welds submitted was lack of penetration. In some cases there was as much as ⅛th inch which was not welded at the bottom of the V. The next most important defect was laps in the weld, that is, places where the added material had been dropped into the weld without melting it to the preceding added material. These two defects were the ones most commonly noted in the contest which has just finished. With proper care, both of these defects are usually avoided and should not exist in any good weld.

It would not be amiss for every Welding Supervisor to test all of his welders at frequent intervals in this manner. The time required for making such tests is a small investment compared to the increased efficiency which is made possible.

MARCH MEETING OF A. W. S., CHICAGO SECTION

A meeting of the American Welding Society, Chicago Section, was held March 7th at 8 P. M. in the Monadnock Block, Chicago.

In the absence of Mr. Austin, Chairman, the Secretary was in charge of the meeting and announced to the members the result of the elections. The regular nominees in accordance with the official ballot were elected.

Following the announcement of the results of the elections the new Chairman, Mr. Robert G. Mason, took the Chair and official charge of the meeting.

A paper was read by Mr. C. T. Price upon "Safety in Welding and Cutting." This paper was followed by an interesting discussion of Safety, and those present undoubtedly profited by it.

Mr. Stuart Plumley read a paper entitled "Manufacturing Welded Steel Bed Room Furniture." Photographs of this furniture and the manufacturing operations in producing it, together with samples of electrically welded tubing and Oxy-Acetylene welded mitered joints in this tubing were passed around to the members present. Discussion of this paper followed.

It was regularly moved and seconded and passed by unanimous vote that the Secretary be directed to write a letter to the retiring officers of the Section, expressing the appreciation of the Section for the faithful work which has been so freely given during their term of office.

Following is a list of the officers and directors elected for next year:

Chairman, Robert G. Mason, Atchison, Topeka & Santa Fe Railroad Company, Chicago; Vice-Chairman, Thomas M. Jones, Illinois Steel Company, South Chicago; Secretary and Treasurer, Stuart Plumley, Acetylene Journal Publishing Company, Chicago; Directors for Three Years, H. S. Mann, Metal & Thermit Corporation, Chicago, C. T. Price, Gas Products Association, Chicago, H. G. Austin, National Oxygen Company, Chicago, J. G. Norris, Central Steel Wire Company, Chicago; Directors for Two Years, W. M. B. Brady, General Electric Company, Chicago, H. S. Card, *The Welding Engineer,* Chicago, W. L. Senhert, Chicago Welded Products Co., Chicago, Ernest Lunn, The Pullman Company, Pullman, Ill.; Directors for One Year, E. L. Swangren, Western Electric Co., Chicago, W. P. Roberts, Air Reduction Sales Co., Chicago, K. R. Hare, Transportation Engineering Corp., Chicago, Jonathan Wolfe, Chicago Surface Lines, Chicago; Director to represent the Chicago Section at the Directors' meetings of the American Welding Society, W. A. Slack, Torchweld Equipment Company, Chicago.

WELDED STEEL AUTO WHEELS

How Clamps and Jigs Are Used in Production Welding, to Speed Operations and Eliminate Warpage

Paris, France,
Sunday

Dear Ed:

Well, I certainly thought I would be over in Germany by now but here I am, still in France. Everything is so interesting here that I find it hard to break away. However, I may pack up any time now and move along. Get a little homesick for the good old U. S. A. every once in awhile, so you know the answer. Had a rare time today; went out to the races at Chantilly. Most of the crowd goes by train but I grabbed an autobus just to see the country. It was wonderful to roll over the hills and valleys deep, through the wee villages and finally wind up at this big forest. The foot paths through the woods were all lined with venders,

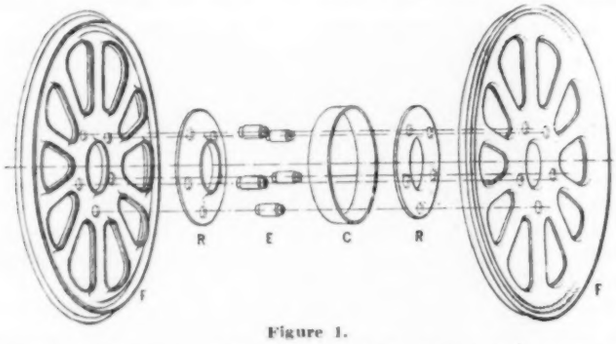


Figure 1.

shouting their wares. Coming out of the forest the race track suddenly loomed up. On one side of the track the grand stands were filled with thousands of people, while on the inside of the track there were just as many more. The races themselves caused very little excitement. It was the betting everybody was concerned about. There were stalls everywhere for placing bets. These were all operated by the government and it is a painless way of collecting taxes. The fee collected is something like ten per

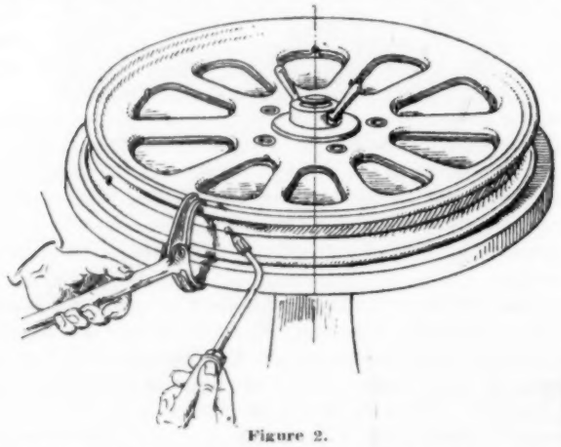


Figure 2.

cent of all monies handled. This is simply taken from the purse of the winner. It is never noticed. It certainly is a treat to see some of those families place a five franc bet and win. It pleased them just as much as if they won a million.

But aside from the horse races, Ed, methinks I promised you some more dope on French welding methods. I've picked up so many stunts that I hardly know which will interest you the most. Ah! Here is a welded steel wheel for automobiles that's a peach. I have a few views on it too that I'll enclose so you'll have the full benefit. For these I'm indebted to Messrs. Granjon and Rosenberg, of the Office Central. Now remember, Ed, the point I wish you to bear in mind is not so much the manufacturing of steel auto wheels for I know that won't interest you; the main idea, in passing these stunts on to you, is to give you "food for thought." The process used in turning out this wheel may give you an idea how to make something entirely different by the same procedure.

This wheel is made out of pressed steel and then welded together. So far the actual making is concerned methinks I'd better set it down just as I received the information so there won't be any mistakes..

"You see the two principal parts are the sides," said my guide. "These we do not make here for they must be made on large presses with special dies and here we are not equipped to do

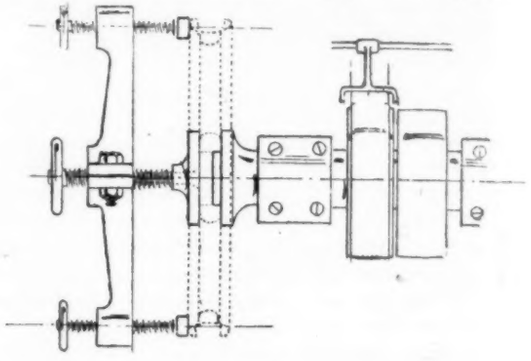


Figure 3.

it, so we ship them in as you see them. The other parts amount to little; here we have them. There are two collars, a spacer and five hollow tubes. The latter are to bind the halves together at the center and make provision for bolting the hub in place." (See the sketch I've marked Fig. 1.)

"Now the first step in the manufacture is the assembly," he went on. "These two collars (part marked R) are slipped over the ends of the five little tubes (see parts marked E) and the spacer (the part marked C) surrounds them. Held in this posi-

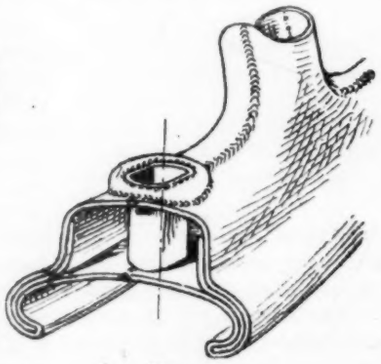


Figure 4.

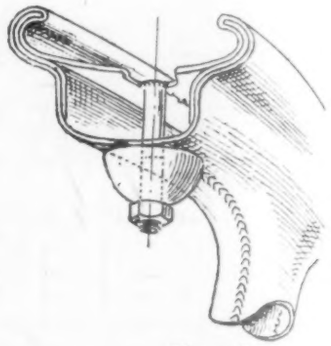


Figure 5.

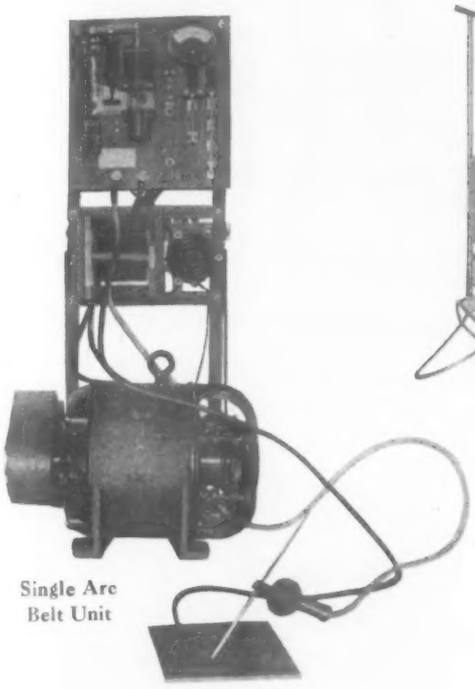
tion by a clamp they are 'tack welded' at four different spots on the circumference."

"After this, the heart of the wheel, as this center assembly might be called, is welded together. First around the inside where the flanges of the two collars meet, and then around the outside circumference. This makes a good, strong, rigid center piece which forms the foundation of the wheel."

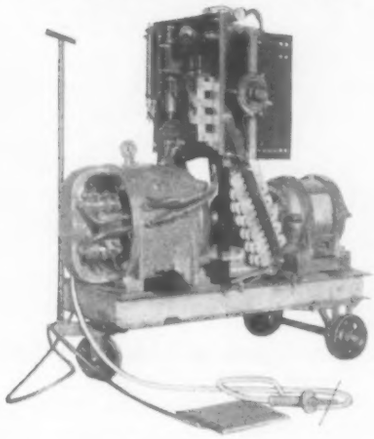
"Welded Wheels For Automobiles"

The next move is to assemble the two side pieces. This is a very simple operation for the ends of the five tubes are long

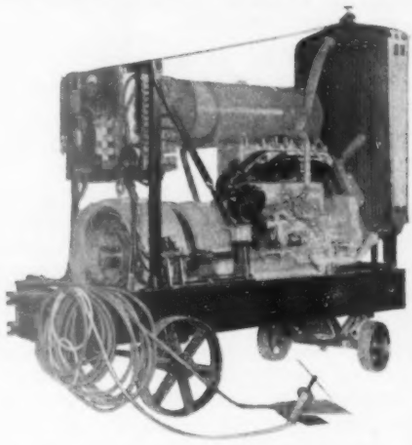
Whatever your welding requirements may be



Single Arc Belt Unit



Single Arc Portable Unit



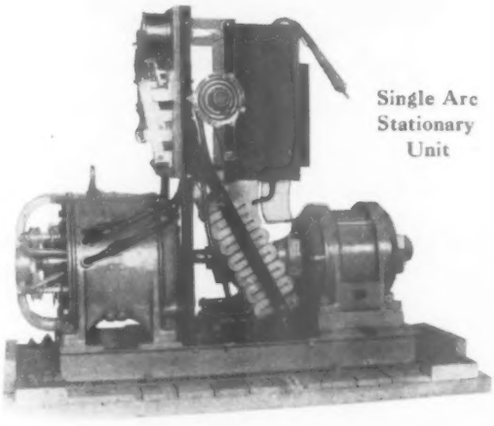
Single Arc Gasoline Engine Driven Unit

WILSON
WELDING MACHINES

AND

"Color-tipt"

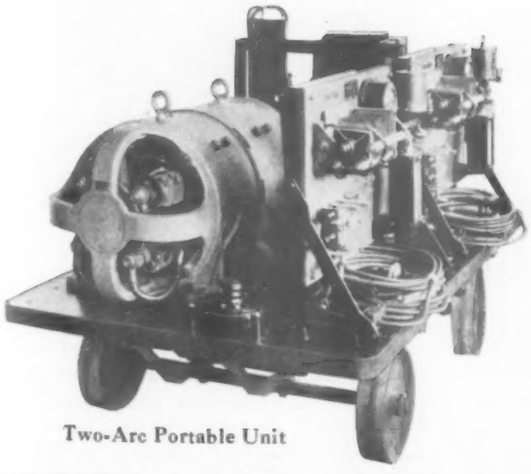
WELDING WIRE



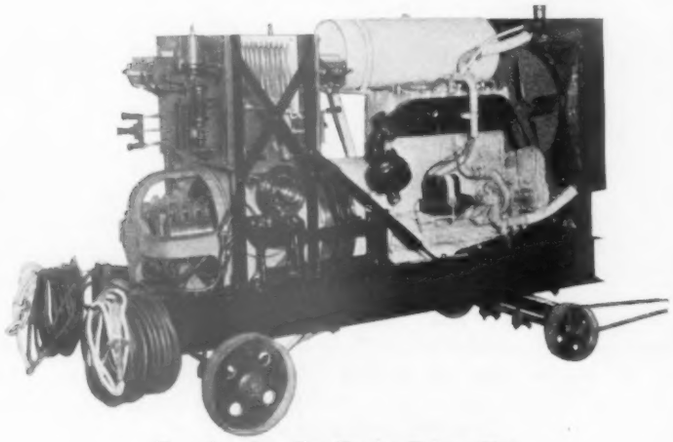
Single Arc Stationary Unit

SPECIAL GRADES FOR WELDING
CAST IRON—BRASS—BRONZE
STEEL—MONEL METAL

Grade No. 12 Monel Metal Produces a Machinable Weld in Cast Iron



Two-Arc Portable Unit



Two-Arc Gasoline Engine Driven Unit

WILSON WELDER & METALS CO., Inc., New York

enough to exend through the sides and in this way, the two halves align themselves without any difficulty.

We moved along and soon were in front of a welder who was handling the wheels in the manner shown in my sketch marked Fig. 2.

"This man 'tacks' the two halves together as you see," continued my guide. "This always impresses me as the most interesting of all the operations. You notice the wheel is slipped over a hub bolt onto what appears to be a table top. This top is made of a heavy casting, faced off and is left free to revolve. The hand-nut in the center, clamps the whole wheel together and holds it in this position while the 'tacking' takes place. Now sometimes the heat from the torch causes the edges along the rim to separate. For this reason the special hand clamp the welder is now using is employed to overcome this. As the heat is being applied the operator holds the parts in position with this clamp. Notice, if you will, how first the parts nearest the hub are 'tacked' together; then the inner side of the rim and lastly the outside of the rim. Since the wheel is held down to the finished surface of the table while all this takes place, there is very little opportunity for it to warp or get out of alignment."

Well, Ed, it really was interesting to watch this operation. The whole idea was good, but that hand clamp was the best thing I have seen in a long while. I believe you can see how it is made from the sketch. So simple, yet so efficient.

The wheels were then passed on to the welders. There was nothing really outstanding in this welding operation. Mandrels rotated the wheels while the outside rim weld was being made, but the balance of the seams were welded in the usual manner. The welding progressed very rapidly for the parts all being 'tacked' together in such a good manner beforehand, there was little chance of buckling or warping. There was the matter of alignment that rather disturbed me. I realized that the wheels wouldn't be much good unless they ran true. Not seeing any way of checking this up, I put my question to the guide.

"Ah! You need not worry on that score, monsieur. That is all well taken care of in the next department where we will go immediately."

It was there that I saw how these wheels were all checked up for trueness. Testing, or you might call them correcting, machines turned the wheels and adjustable screws forced the rim one way or another. You can see the general scheme from the sketch marked Fig. 3. There is a tight and loose pulley on the arbor. When the wheel is being mounted in place the power belt runs on the loose pulley. When testing, the belt is shifted to the tight pulley. I was really surprised to see how rapidly these wheels could be trued up.

I naturally thought this finished the wheel, all but the painting. In this I was mistaken, for I noticed the wheels were being taken from this last operation over to another welding department.

"There is more welding work to be done on these wheels?" I asked.

"Ah yes!" Came the answer. "There are two more operations before the wheels are finished. Come this way and I'll show you. You see here they are putting in the little tubes through which the valve for inflating must pass. This operation, as you will note, does not require much time. The little tube is slipped in place and welded on each end."

This by all rights should be the end, thought I, but I was certain that he had said there were two other operations. The wheel surely seemed complete now; what possibly could they add? My curiosity was not satisfied when I was led over to another place where an operator was busy welding bolts in the rim just opposite the valve stem hole. Quite the reverse! What possibly could this be for? I figured there was only one way to learn and that was to ask; so I did.

"That bolt, if you will observe, is exactly opposite the valve stem slot," I was informed. "It holds the weights which we put on to counterbalance the weight of the valve and make the wheel smooth running."

That sure was one on me, Ed. Just for that I'm going to make you a little sketch showing how the valve stem casing and this counterbalance bolt, that caused me all this anxiety, appear.

The factory making these wheels is now turning out sixty wheels a day but they are going so strong that the management is seriously considering increasing the capacity of the plant. All of which goes to show that welded products are opening up new fields and meeting with public favor the whole world over.

For a loafer, I've a strenuous day outlined for tomorrow, so will sign off right now.

Regards to all.

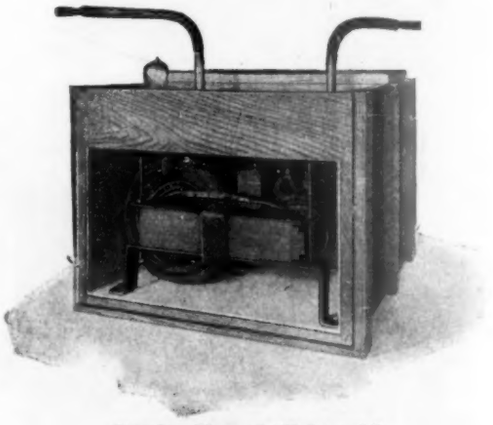
SHEP.

ALTERNARC UNIVERSAL WELDING MACHINE

The Electric Arc Cutting and Welding Company, Newark, N. J., are announcing a new type of welder called the "Universal." The word "Universal" is used to indicate the application of this

Alternarc Universal Welder.

welder in connection with any industrial power supply. The company has always made machines applicable to one or two voltages such as 220-440 or 110-220, but now the scope of development has been broadened so that practically any power supply can be used with one unit of the apparatus. This unit is not larger than the regular size. For example, 110-220-440 volt com-



Interior View of "Universal."

binations are obtained by multiple, series multiple and series combinations of the coils of the primary winding. To make the same machine operate on 25 and 40 cycles, taps and adaptor windings are used to obtain the proper electrical characteristics. In addition to this the apparatus is also made operative on 110 and 220 volts D. C. by means of a resistor-reactor combination inserted in the secondary winding.

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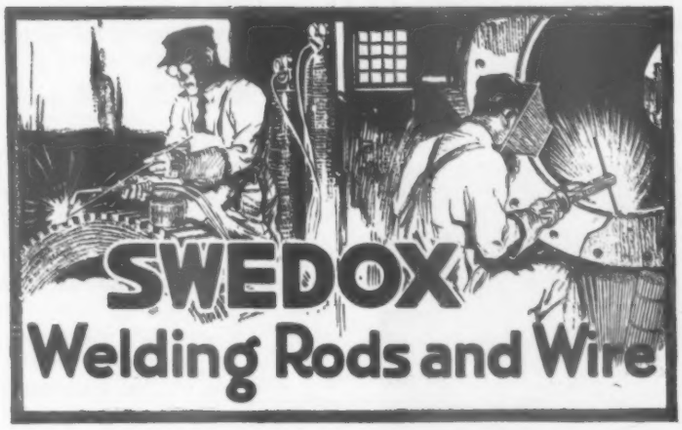

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COATED ELECTRODES

CASTOX-BRONZOX
ALUMINOX FLUXES.

SWEDOX welding wires and rods can be supplied immediately from stock, conforming in all respects to:

American Welding Society Specifications E No. 1-A; E No. 1-B; E No. 1-C; G No. 1-A; Folios No. 1-E and No. 1-G; and many others. We can furnish a welding wire or rod for any purpose and of any analysis required.

PUT YOUR WELDING TROUBLES UP TO US Let us prescribe the filler best adapted for your requirements. We maintain a research department conducted by experts for the benefit of our customers. This service is FREE OF CHARGE.

FLUXES—CASTOX, BRONZOX and ALUMINOX FLUXES when used with the corresponding non-ferrous filler rod will keep impurities out of the weld and promote thorough fusion.

FREE trial samples of any product will be furnished upon request. A trial of any SWEDOX product will convince you of its superiority. Send for these samples NOW

CHICAGO, ILL.
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Central Steel & Wire Company

DETROIT, MICH.
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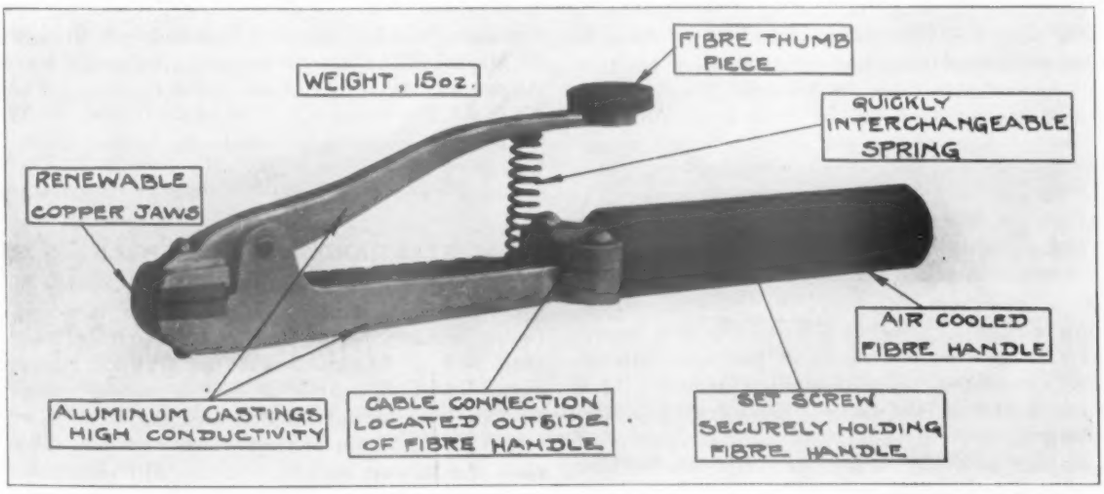
The ELECTRODE HOLDER
with the Qualities Appreciated by the Welder


FIBRE THUMB PIECE
WEIGHT, 15oz.
QUICKLY INTERCHANGEABLE SPRING
RENEWABLE COPPER JAWS
AIR COOLED FIBRE HANDLE
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CABLE CONNECTION LOCATED OUTSIDE OF FIBRE HANDLE
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Price, $6.00

Let us mail you one for inspection. If you don't consider it a decided advance—return it.

GIBB INSTRUMENT CO., BAY CITY, MICHIGAN

DEALERS WANTED

Mfrs. Arc, Spot, Seam and Automatic Welding Equipment

WELDING IN THE RADIO INDUSTRY

It would be strange if an industry which serves so many thousands of people as the Radio Industry does should not have to depend upon welding in connection with some of its production. The photograph shown here was taken in the plant of the Federal Telephone & Telegraph Company, Buffalo, N. Y., where three

Welding Radio Cases.

resistance welding machines are used in welding copper cases which enclose the receiving sets manufactured by the Federal Company. The copper case shown in the photograph is the one used for the Federal type 58, four-tube receiving set. After the cases are welded they go through an enameling process. The welding machine used here is the Federal Machine & Welding Company type 112, which is rated at 10 kw; 220 volts; 25 cycle.

TANK MAKERS HOLD STANDARDIZATION CONFERENCE

Manufacturers of tanks and manufacturers of equipment, in which tanks are used, have been invited to meet in a series of conferences under the auspices of the Division of Simplified Practice on March 11, 12, 13 and 14, looking to the elimination of seldom-used sizes and varieties of tanks. More than 150 manufacturing representatives from 24 states have been invited, as well as delegates from the National Board of Fire Underwriters, American Institute of Architects, American Society of Sanitary Engineering, and other technical groups and from fire departments of a number of leading cities. Distributors and consumers will be present.

The conferences will deal with hot water storage tanks, cold water storage tanks, pneumatic tanks, gasoline underground storage tanks, distillate and fuel oil storage tanks, and air receivers.

The meeting will be a sequel to conferences held during January. At that time manufacturers of hot water storage tanks agreed on tentative recommendations reducing their products to five sizes and two working pressures. Manufacturers of pneumatic tanks, at that time also, were in favor of a reduction of their products to nine sizes and one working pressure. These developments resulted in a request to the Division of Simplified Practice for assistance in bringing about simplification of cold water storage tanks, gasoline storage tanks, fuel oil and distillate tanks, storage tanks for oil heating systems, and air receivers.

Through the cooperation of the Division, ten other companies have applied simplification measures estimated to be saving millions of dollars annually, through the reduction of cost of production, of inventories, through increased sales at lower expense. Distributors and consumers benefit, it has been found, from improved service on the part of manufacturers. Some of the industries which are now using simplified practice include paving brick, face brick, asphalt, hollow building tile, bed blankets, range boilers, files and rasps, forged tools, woven wire fence, and metal lath.

MINNEAPOLIS FEATURED AS CENTER OF COMMERCIAL GAS INDUSTRY

In a recent issue of the Minneapolis Journal considerable space is devoted to a description of the oxy-acetylene industry, with particular reference to the large territory supplied with gas made in Minneapolis. The writer of the article has collected some very interesting statistics on the value of the oxygen and acetyline gas produced in the city; on the use of either gases for oxy-acetylene welding and cutting, and on the progress made by local plants.

The article quotes a series of interviews with Managers and Superintendents of the following well known plants in Minneapolis: The Commercial Gas Company, 2633 Fourth Street, S.E., commercial oxygen and hydrogen gas; The Smith Inventions, Inc., 2633 Fourth Street, S.E., oxygen gas apparatus and acetylene gas producing plants; The Air Reduction Sales Company, 327 Twenty-fifth Avenue, S.E., oxygen and acetylene gas; The United States Welding Company, 120 First Street, N., commercial gas apparatus; The Prest-O-Lite Company, Inc., St. Louis Park, acetylene gas; The Linde Air Products Company, 809 East Hennepin Avenue, oxygen gas.

HAYES GOES TO NEW POSITION

John H. Hayes, who for the past seven years has been secretary and treasurer of the Compressed Gas Manufacturers' Association, has announced his resignation to take effect March 31st. On April 1st, Mr. Hayes goes to a new position with the Ohio Chemical and Manufacturing Company, Cleveland, Ohio.

JOHN F. ALVORD

With deep sorrow we announce the death of John F. Alvord, founder and owner of the Electric Arc Cutting and Welding Company, Newark, N. J. Taken suddenly ill on the evening of March 12, he passed away the following morning. Mr. Alvord was also owner of the Splitdorf Electrical Co., Newark, N. J., the Torrington Co., Torrington, Conn., the Wire Wheel Corporation of America, Buffalo, N. Y., and the Hendee Mfg. Co., Springfield Mass.

STANDARD WELDING PLANT SOLD

The Standard Welding Plant of the Standard Parts Co., Cleveland, consisting of eight acres of land and buildings having between 400,000 and 500,000 sq. ft. of floor space, has been sold to Andrew Squire, an attorney representing unnamed interests, subject to confirmation of court on March 15. The creditors of the Standard Parts Co. have so far received 68½ per cent of their claims and with the sale of this plant the amount paid to creditors will be approximately 75 per cent.

The Memphis Oxygen Company has recently moved its office to 48 McLemore Avenue, Memphis, Tenn.

The Gas Products Association, 140 South Dearborn Street, Chicago, has prepared rules for the safe handling of cylinders, containing compressed oxygen, hydrogen and acetylene.

ANNOUNCING
E. R. NASH
HANFORD, CALIFORNIA

Winner of $100.00 Cash Prize for Best Steel Weld

20 FOLLOWING RECEIVED HONORABLE MENTION

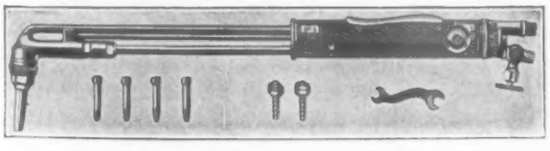
No. 699—W. S. Inman, Deer Lodge, Mont.
No. 1977—Frank W. Tracey, Trona, California.
No. 2002—C. E. White, Niagara Falls, Canada.
No. 2558—O. G. Klein, Richland Center, Wis.
No. 3803—Luther Kemper, Waynesboro, Pa.
No. 4005—Bert E. Smith, Brainerd, Minn.
No. 4484—S. E. Stoner, Dysart, Iowa.
No. 4887—Ernest A. Workman, Davenport, Ia.
No. 5098—Larry Cooney, St. Louis, Mo.
No. 6049—Chas. H. Smith, Santa Ana, Calif.
No. 7642—A. B. Tolle, Evansville, Ind.
No. 7684—John Volz, Holdredge, Nebr.
No. 8021—S. E. Stoner, Dysart, Iowa.
No. 8036—George C. Wolph, Fostoria, Ohio.
No. 8188—Henry Maurer, Bloomington, Ill.
No. 8239—J. W. Baldwin, Wamego, Kansas.
No. 8372—Patrick Callahan, Chicopee, Mass.
No. 8444—Luther Kemper, Waynesboro, Pa.
No. 8861—Jack R. Thomas, Kansas City, Mo.
No. 8959—Geo. C. Graves, Hopkinsville, Ky.

UNITED STATES WELDING CO.
(Makers of Famous "U. S." Welding and Cutting Apparatus)

MINNEAPOLIS MINNESOTA

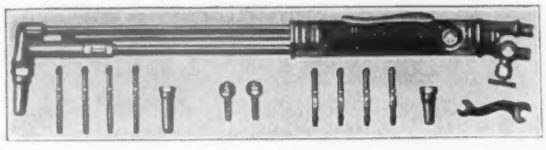
You Can Do It Better With TORCHWELD

DISCRIMINATING BUYERS always have their judgment confirmed when they select Torchweld Equipment because Torchweld Welding and Cutting Apparatus is so sturdily built that its performance under all sorts of operating conditions exceeds the expectations of the purchaser.



General Utility Cutting Torch.
Torchweld-Style 15 M. C.

Used for production cutting wherever a hand torch may be used. A wide range of service is offered because the one-piece tips are obtainable in special lengths and special shapes to suit individual requirements.



Heavy Duty Cutting Torch.
Torchweld-Style 25 M. C.

Used with Standard or Foundry Type tips of two-piece construction, for extra heavy cutting work or on dirty, rusty or scaly material, for cutting risers, billets, wrecking work, railroad work, steel mill work, etc.

Service Satisfaction and Dependability are built into Torchweld Equipment and as the result, Torchweld users find that its earning power is more than enough to pay for the equipment itself many times over during its life.

Send for Catalog Number 23

TORCHWELD EQUIPMENT COMPANY
224 NO. CARPENTER ST. CHICAGO, ILL.

News of the Welding Trade

The Linde Air Products Company is about to commence a one-story addition to its plant at 155 Chandler Street, Buffalo.

W. J. Thomas, who has been associated with The Purox Company in California for some years, has been given charge of the Kansas City branch at 1739 Walnut Street. C. W. Rambo has joined The Purox Company sales-service force in the newly re-organized Kansas City branch.

The Emerson-Scheuring Tank Company, recently incorporated in Indianapolis, Ind., is now under production. They are manufacturing tanks and other arc welded products. The company is under the management of C. E. Scheuring, vice-president, who has had long and wide experience in the manufacture of tanks.

A branch office of the Transportation Engineering Corporation has been established in Cleveland, Ohio, to serve the territory embracing the state of Ohio, Western New York and Pennsylvania, and as far west as Detroit, Mich. O. L. Howland is in charge as district manager.

C. J. Nuquist, of the Carbic Manufacturing Company, Los Angeles, Calif., calls attention to the fact that when a gasoline tank exploded and injured a workman, the newspaper reporter actually succeeded in getting the facts right in reporting the accident as being due to the application of a soldering iron to a tank containing a small amount of gas.

S. H. Smith, of the Universal Oxygen Company, Milwaukee, Wis., was a visitor in Chicago March 11th. Sam says that business is good in Milwaukee and vicinity.

At a meeting of the New York Section of the American Welding Society, held February 11th, papers were presented by A. F. Keogh, on the subject of "The Job Welding Shop," and C. J. Holslag, on the subject of "Practical Welding." Mr. Holslag's paper was illustrated by lantern slides.

The San Francisco Section of the American Welding Society met February 15th. The program consisted of a illustrated lecture by Mr. H. Rhine on the subject of "Automatic Arc Welding," and a discussion by Mr. John Janusch on the "Need of Better Welding Schools."

The Canadian Welding Journal has been amalgamated with The Canadian Manufacturer, which is published by the Commercial Press, Ltd., 51 Wellington St., West, Toronto.

The Buckeye Oxygen Company, of Canton, Ohio, recently joined the Compressed Gas Manufacturers' Association of New York City.

The Thermalene Sales Company of Chicago and the Smith-Lawson-Coambs Company, of Chicago, recently joined the Gas Products Association as associated members.

Oxygen producers are showing considerable interest in the recent report that the inhaling of a small quantity of oxygen will prevent sea sickness or cure it.

The name of the Boston Electrolytic Oxygen Company, Boston, Mass., has been changed to the New England Compressed Gas Company. Mr. Mooney announces that this is simply a change in name, nothing else being involved.

Frederic E. Wright, who is well known in the oxy-acetylene industry has recently joined the sales department of the International Oxygen Company.

The Committee on Gases of the National Fire Protection Association met on Thursday, March 6th, to act on the subject of the changes in their regulations for the installation and operation of oxy-acetylene equipment.

In addition, courses for teachers and supervisors will be given in Home Economics, Music and Art.

At the February meeting of the American Welding Society, Cleveland Section, Mr. C. F. Nagle, Jr., of the Aluminum Company of America, read a paper on "The Welding of Aluminum," and Mr. L. S. Burgett, of the Rail Welding and Bonding Company of Cleveland, gave a talk on "The Welding of Copper to Steel."

Mr. W. L. Fanning, works manager of the Australian Oxygen & Industrial Gases Company, and representative of the Victorian Oxy-Acetylene Welding Section on the Board of Management of the Victorian Automobile Chamber of Commerce, is about to enter on a world tour, and will make an extensive study of up-to-date methods in oxy-acetylene welding in the course of his visit to the United States.

Smith's Inventions, Inc., Minneapolis, Minn., recently issued a well printed little folder containing quite a collection of stories describing how welders are using A-MAL-GAM in connection with cast iron brazing jobs.

It is reported that the Air Reduction Sales Company are planning to erect new plants this year at Harrisburg, Pa., and Lima, Ohio.

The capitalization of the Thomson Spot Welder Company, of Boston, has been reduced from $598,300 to $250,000 by eliminating the outstanding preferred stock.

An oxygen producing plant is being erected at Portsmouth, Ohio, by M. Keith Dunham, Chicago, with capacity of 2,000,000 feet per month.

Mr. Robert Malcom, president of the Chicago Eye Shield Company, recently returned from a trip to the Pacific Coast where the welding industry seems to be quite active.

The Davis Welding & Mfg. Company, 1110 Richmond Street, Cincinnati, Ohio, is getting ready to complete a new plant in the Evoydale section. It is estimated that the cost of the new plant complete will be in the neighborhood of $100,000.

The office of the Manganese Steel Forge Company, Philadelphia, has moved from 1523 Real Estate Trust Building to Richmond Street and Erie Avenue.

The Denver, Colo., office of The Purox Company was recently moved to the Boston Building, 828 17th street.

Adolf Messer, of Frankfort, A. M., Germany, manufacturer of air liquefaction oxygen producing plants, acetylene generators and oxy-acetylene welding and cutting apparatus, has been spending a few weeks in the United States. During the latter part of February, he spent several days at the office of M. Keith Dunham, of Chicago, who is a distributor in this country for oxygen producing plants.

H. B. Hoover Company has opened a shop at 213 N. Church Street, Rockford, Ill., where it will do general weld-

ing, radiator work and general automobile repairing. Mr. H. P. Hoover, head of the company, was formerly proprietor of the American Welding Works, at Rockford.

The Pacific Safety Conference, to be held at the St. Francis Hotel, San Francisco, April 7 to 9, is under joint auspices of the Society of Safety Engineers of California and the Engineering Section of the National Safety Council. The third conference, which is scheduled for the forenoon of April 8th, will include a discussion of Safety in Gas Welding and Cutting.

M. Keith Dunham, of Chicago, is installing oxygen producing plants for the Burdett Oxygen Company, of Cleveland, Ohio, and the Electrox Company, of Peoria, Ill.

NIGG ARC WELDER

Mackey & Harris, of Los Angeles, Calif., are distributors of a new type of Electric Arc Welder which has had considerable success in the Pacific Coast region. This machine is known as the Nigg Electric Arc Welder. It is an alternating current machine with ranges up to 150 amperes, and up to 200 amperes. The user installs a two-pole single phase 150 or 200 ampere switch depending upon the range and welder ordered. The power company installs a 7½ or a 10 kw transformer, depending upon the range, delivering 110 volts single phase alternating current. Up to 300 ft. of lead wires may be used from the machine to the electric holders. The makers emphasize the suitability of this machine for continuous operation, and the ease of operation. It is also pointed out that it differs from other types of alternating current arc welders in that it does not make use of a transformer, being what is known as reactance type of welder.

Welded Pressure Vessels

For several years efforts have been made to draw up a Code for the Welding of Unfired Pressure Vessels. Opinions of the best welding experts were not in agreement on many essential points. Fundamental scientific knowledge based on test data was not available. The American Bureau of Welding has completed a series of tests on some 47 tanks. The program involved an expenditure of over $15,000. The test data, analysis of same, conclusions and recommendations to the Boiler Code Committee of the A. S. M. E. has been compiled in a report, copies of which are available for distribution at $1.50 to members and $5.00 to non-members.

American Welding Society

33 West 39th Street New York, N. Y.

Classified Ads

Help Wanted—75c per line, minimum 4 lines.
Jobs Wanted—4 lines free.
Other Ads—$1.00 per line, minimum 4 lines.
Counted 8 words to line. Add 6 words for keyed address

Position Wanted—Oxy-acetylene welder. Have diploma from Michigan State Auto School. Have been welding since leaving the school. Address, Norman Smith, Goshen, N. Y.

Position Wanted—Experienced welding engineer in Great Britain desires connection in U. S. Technical welding expert for eight years with leading British firm. Has thorough marine and electrical engineering training; also sales training. Address 26, care The Welding Engineer.

SALESMEN AND AGENTS

Positions and **Territory** open for aggressive men to sell Milburn Welding and Cutting apparatus, the product of 20 years' specialized development and manufacturing experience in the industry. Supported by trade journal advertising and intensive mail campaign. Highest quality of apparatus, Milburn guarantee. Preference given to men with welding experience or firms with welding trade. Write in confidence.

THE ALEXANDER MILBURN COMPANY

1416-28 W. Baltimore St. Baltimore, Md.

Position Wanted—Expert oxy-acetylene welder wishes position with oil company or job shop in California. Eight years' experience. Railroad and manufacturing. Knows boiler work and heavy cast iron welding. Now employed as foreman. Address V. J. Leasure, 1405 W. Illinois St., Evansville, Ind.

Position Wanted—Electric arc and acetylene welder wants position. Boiler and shipyard experience. Address V. W. Andrews, 28 Brighton St., Charlestown, Mass.

PUROX EXHIBIT AT KANSAS CITY AUTO SHOW

The Purox Company's Kansas City branch showed its progressive spirit during the Kansas City Automobile Show by having a "live" exhibit of Purox equipment. The initiative of Mr. W. J. Thomas in housing the exhibit in a fire-proof Butler-Ready-Made Garage is to be commended.

Cutting with the Oxy-Acetylene and Oxy-Hydrogen torches, both by hand and in a motor-driven machine carrier, of six-

The Purox Exhibit.

inch shafts, four-ply structural steel girders; splitting of shafts, and cutting high carbon steel in strips one-quarter inch thick attracted great attention. Much interest was shown, too, by welders in the welding of high carbon strips without any sign of oxidation or blowing.

WODACK Grinders are Built for the Welder

WODACK Electric Grinders and Drills are made in the sizes and capacities to meet the needs of the welder. Smoothly finished welds mean better pleased customers and bigger profits. If you do Electric Welding, you need not buy expensive air driven tools. We can make WODACK tools to take the current directly from your welder. Write for details about this tool. We can show you how it pays for itself in larger profits.

WODACK ELECTRIC TOOL CORPORATION, 43 S. Jefferson St., Chicago, Ill.

CURRENT WELDING LITERATURE

TANKS FOR AIRPLANES FABRICATED FROM SHEET ALUMINUM BY WELDING, by D. C. McGiehan—A paper recently written for the American Welding Society. How tanks are made which will carry their contents in any position without permitting the contents to change position rapidly.—American Machinist, March 13th.

LOCOMOTIVE FRAME WELDING, by A. F. Dillon—The most convenient method of taking care of expansion and contraction is to use a Frame Spreader. Time and expense is saved by having all apparatus and supplies on the spot before the work is started. On heavy work the use of three or four welders on the job prevents the welder from getting so tired as to slight the quality of the work. Tables indicate the amount of spreading in different sections and the cost of welding different sections.—American Machinist, March 13th.

APPLICATIONS OF OXY-ACETYLENE WELDING AND CUTTING IN THE MINING INDUSTRY, by H. Ulmer—A discussion of the value of welding in the mining fields which are so removed from manufacturing centers that replacements to broken machinery are hard to secure. Important savings made in cutting cast iron and in welding pipes.—Journal of the A. W. S., January.

A CHEAP, RELIABLE AND EXHAUSTIVE METHOD OF TESTING WELDED JOINTS, by A. Menetrier—A discussion of a method of shock bending tests which have proved of great value for an investigation of the relative strength of mild steel welded joints.—Journal of the A. W. S., January.

ONE MORE STEP IN ELECTRIC WELDING PROGRESS, by S. W. Mann—A description of work which is referred to as Precision Welding. A discussion of the possibilities of welding precision jobs such as crank shafts within a very small tolerance.—Journal of the A. W. S., January.

INVESTIGATION OF SEAM WELDED RAIL JOINTS, by R. B. Fehr—General Problem of Rail Joints—Principal Stresses in Seam Welded Joints—Causes of Stresses in Seam Welded Joints—Fatigue of Metals—Improvements in Joint Structure—Improvements in The Welding Process—Decreased Welding Stresses—Advantages of Carbon Arc Process—Development of Method of Testing Joints—Impact Tests and Their Results.—Journal of the A. W. S., January.

SMITHOGRAMS—Monthly publication of Smith's Inventions, Inc.—The current issue contains an article describing the best procedure in welding automobile fenders, and a safety article telling how to avoid accidents when repairing empty gasoline tanks.

SOME CHEMICAL ASPECTS OF WELDING, by J. R. Booer—A discussion of the chemical changes which take place during the welding process and their importance in the operation. Particular attention is given to oxidation and to a chemical discussion of various oxides. The chemistry of the Oxy-Acetylene Flame is also explained. Slag formation is an important subject. The use of Fluxes is explained from the point of view of the chemist.—Acetylene and Welding Journal, London, February.

WELDED RAIL BONDS, by H. H. Febrey—A discussion of oxy-acetylene and electric arc processes as applied to the attachment of copper bonds to steel rails.—Acetylene and Welding Journal, London, February.

WELDING STANDARDIZATION IN LOCOMOTIVE SHOPS, by James S. Heaton—A Review of the Various Methods Used on Boilers, Fireboxes and Running Gear—The Keeping of Proper Records—Standardization of Equipment—Layout of a Welding Shop—Training of Welders—Instructions for Welding Boilers—Forms Used for Reporting Boiler Work and Frame Work.—Railway Mechanical Engineer, March.

WELDING BY MEANS OF THE ELECTRIC ARC, by Robert Siemer—A General Description of the Principles Involved in the Electric Arc Welding Process—Explanation of the Difference Between Carbon Electrode and Metallic Electrode Welding—Discussion of the General Field of Application of the Electric Welding Processes, With Mention of Some of the Important Welding Jobs on Record.—American Blacksmith and Motor Shop, February.

FABRICATING STEEL CYLINDER HEADS BY THE OXY-ACETYLENE TORCH.—How a job shop located in a mining community made a success of fabricating cylinder heads by oxy-acetylene welding and cutting.—American Machinist, February 18th.

ELECTRIC ARC WELDING OF CAST IRON—The preparation of test pieces for experimental work in Arc Welding Cast Iron—Acetylene and Welding Journal, London, January.

MANUFACTURING WELDED STEEL BEDROOM FURNITURE—Extensive Production of Steel Furniture at Simmons Company's Plant at Kenosha, Wisconsin. Description and illustration of the use of Oxy-Acetylene Welding in the fabricating of metal furniture.—Acetylene Journal, March.

OXY-ACETYLENE WELDING AND CUTTING IN RAILROAD REPAIR SHOPS—Application of The Oxy-Acetylene Process in the Plant of the General American Tank Car Corporation, at East Chicago, Indiana. At present fifty welding and cutting stations are in constant use. A survey of the use of welding and cutting for both production work and reclamation work is given.—Acetylene Journal, March.

MACHINE TORCH CUTTING IN THE FORGE SROP, by Fred E. Rogers—The use of the Oxygraph for Cutting Heavy Forgings.—Acetylene Journal, March.

THE INFLUENCE OF MASS UPON METHODS OF PREHEATING AND WELDING LARGE IRON CASTINGS—A discussion of this subject is illustrated by showing the right and wrong methods of preheating a particular job.—Acetylene Journal, March.

STANDARDIZATION OF WELDING COST FINDING METHODS—Illustrating the value of standardization of practice in applying the welding or cutting process. Examples of Office record cards and Shop record cards are shown.—The Canadian Manufacturer, February.

Standard Steel & Wire Co., Chicago, has moved general offices from 549 West Washington Blvd. to 1408 Courtland St.

W. T. Funston, Carbic representative in St. Louis, was in Chicago this month for the Railway Appliances show.

The Metalweld Service Corporation, 1435 North Thirty-first Street, Philadelphia, is planning a new welding and machine works at Fox Street and Hunting Park Avenue.

The Paschall Oxygen Co., Philadelphia, has joined the Gas Products Association as an active member.

The Helwig Welding & Repair Co., 1470 Springfield Avenue, Irvington, N. J., recently incorporated to operate an electric welding shop.

SALLWELD
ASBESTOS PAPER

SAL-MO PRODUCTS
Trade Mark

In rolls 36 inches wide weighing approximately 100 pounds each.

SLOWS UP COOLING PROCESS

No obnoxious or injurious fumes.

KEEPS DIRT OUT OF WELD.

Manufactured by
SALL MOUNTAIN COMPANY
140 So. Dearborn Street Chicago, Ill.
Eastern Office, Scranton, Pa.

SAFETY DEMANDS

Mattingly Safety Valves on all Gas Welding and Cutting Apparatus. Don't wait for this fact to be blown into your head by an explosion. prevent the explosion. and your Business.

Order the Safety Valves and Save Gas, Protect the Welder

Thousands in use. Ask for Literature.

MATTINGLY AUTOMATIC VALVE CO.
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WELDING RODS

ROL-MAN For Gas Welding For Electric Welding ROL-MAN

Manganese 12.00 - 15.00% Carbon 1.00 - 1.45%

ROL-MAN MANGANESE STEEL for MAXIMUM WEAR

For TRACK WORK, MILLS, MINES, FURNACES, SMELTERS, CRUSHING, SCREENING & DREDGING PLANTS

A True High Manganese and High Carbon Product in Rolled Rods and Drawn Wire Presents Highest Abrasive Resistance and Maximum Wearing Qualities

Standard Sizes and Lengths Plain or Coated
MANGANESE STEEL FORGE CO.

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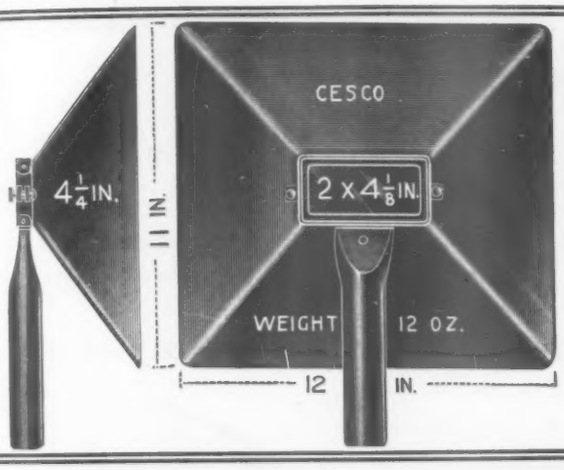
PHILADELPHIA, PA.



CESCO HAND SHIELD

Style No. 10—Made of Black Vulcanized fibre formed as **cut shows** to eliminate all light rays. Fitted with our **Essentialite Welding Glass,** which is scientifically correct. Lenses are easily changed by the new device. The jobbers that have seen **Cesco Hand Shield** pronounce it the best made.

Send for a sample and be convinced.
Cesco Hand Shield No. 10 sells for $3.00 each.

Manufactured by

Chicago Eye Shield Co.

2304 Warren Avenue **Chicago, Ill.**

Superior Oxy-Acetylene Machine Company

Hamilton, Ohio, U. S. A.

Manufacturers of

WELDING AND CUTTING TORCHES, REGULATORS AND GAUGES,
SPECIAL BRASS PARTS, WELDING AND CUTTING OUTFITS,
CARBON BURNING AND LEAD BURNING OUTFITS, ELECTRIC DRILLS AND GRINDERS
CAST IRON—STEEL—BRASS AND ALUMINUM RODS, HOSE, FLUXES AND GOGGLES,

PEERLESS GENERATORS, as shown, are built in four sizes:

Carbide capacity	Cu. ft. of gas	Price
10-lb.	50 cu. ft.	$100.00
15-lb.	75 cu. ft.	110.00
20-lb.	100 cu. ft.	130.00
25-lb.	125 cu. ft.	150.00

(Allowance on acetylene tanks)

These Generators are PORTABLE, can be moved from one place to another, weighing about 135-lbs.

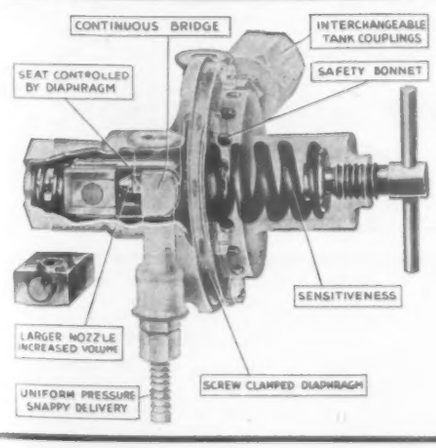
AUTOMATIC, equipped with the CELEBRATED SUPERIOR FEED.

GENERATES gas for about $1.20 per 100-cu. ft.

Batteries—Lead Molds—Post Builders—Lead Pots—Plate Burning Racks—Stencil Letters and Figures—Trucks—Preheaters.

Write for complete catalog.

We repair all makes of Torches, Regulators and Gauges.



Self laudation is seldom convincing but the opinion of others is not to be ignored

SAFETY SERVICE MECO EFFICIENCY ECONOMY

MULTI-SEAT REGULATORS

Modern Engineering Company

3411-13 Pine Blvd. **St. Louis, U. S. A.**

Mr. Torch Manufacturer will you give us an opportunity to convince you at our expense? Our prices will surprise you.

Welding Carbon Products

National Round Welding Carbons
National Welding Carbon Plates
National Welding Carbon Paste
National Welding Carbon Flour

Our welding carbon products are designed especially for welding operations

National Carbon Company, Inc.
Cleveland, Ohio San Francisco, Cal.

Canadian National Carbon Co., Limited
Factory and Offices: Toronto, Ontario

CAST IRON RODS
MADE FROM PIG IRON
(NO SCRAP USED)

Approximating
3.00%—in Silicon (Result: A soft weld)
.60%—in Phosphorus (Result: Fluidity)
.02%—in Sulphur (Result: A clean weld)

Our Rods the Best by Test. Also Rods, Wires and Fluxes for Welding All Other Metals

Prices on Application

Bierman-Everett Foundry Co.,
133-153 So. 20th St., Irvington, N. J.

OXYGEN
FOR CUTTING, WELDING, ETC.

Quick shipment and low prices on oxygen, hydrogen, cylinders, valves, Rego welding and cutting torches, regulators, welding wire, cast iron and aluminum rods, fluxes, plain and armored rubber hose, asbestos pads and paper, goggles, etc. All equipment fully guaranteed.

We are American pioneer manufacturers of oxygen. Write for catalog and prices.

International Oxygen Company
Main Offices: NEWARK, N. J.
Branch Offices: New York, Pittsburgh, Toledo.

Specify—
"MOREY"

A Moisture Proof Aluminum Flux
Stable, Economical, Marvelous

MOREY FLUX & CHEMICAL CO.
Parkesburg, Penna. U. S. A.
Est. 1912 Inc. 1915

QUASI-ARC SYSTEM

We Manufacture:
A. C. & D. C. Welding Sets
Also Weldtrodes for
Mild Steel
High Carbon
Manganese
Cast Iron

L. W. 110 V. WELDER Gives Machinable Weld

QUASI-ARC WELDTRODE CO., INC.
Peekskill, New York

Scored Cylinders and Cracked Water Jackets made good as new without warping or removing from the car, by the New Metal

FERROITE

Manufactured by
THE WELDING METALS MFG. CO. 4403 Perkins Ave., Cleveland, O.
Write for exclusive agency

A WELDING ROD HOLDER
For the Oxy-Acetylene Welder

If you are selling welders' supplies, keep a few welding rod holders in stock. There is a growing demand for this handy tool. Write for Prices and Samples.

C. SORENSEN
18 E. 16th Street, Chicago, Ill.

Westinghouse

manufactures complete arc welding equipment for all welding and cutting purposes. Write for Leaflet 1826-B which describes this equipment in detail.

Westinghouse Electric & Manufacturing Co.
East Pittsburgh, Pa.

For Gases Charged at High Pressures
WM. WHARTON, JR. & CO., INC.
30 Church St., New York, N. Y.

IMPERIAL WELDING AND CUTTING EQUIPMENT
OXY-ACETYLENE PROCESS

A new mixing principle, a regulator that accurately controls gases, the greatest working range ever covered by ONE torch—are exclusive IMPERIAL features. Write for catalog.
Imperial Brass Mfg. Co., 517 S. Racine Ave., Chicago

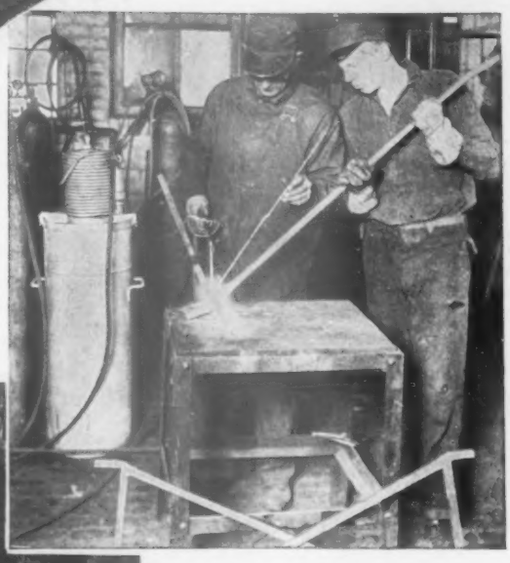
DAVIS-BOURNONVILLE COMPANY
was merged with
AIR REDUCTION SALES COMPANY
on March 17, 1922

The Oxyacetylene Welding and Cutting products formerly manufactured by Davis-Bournonville Co. are now made and sold by Air Reduction Sales Co. under the trade name of "Airco-Davis-Bournonville" or "Airco-D-B."

(See advertisement of Air Reduction Sales Co.)

Carbic

Big Jobs



or Small

THE size of the job means nothing to Carbic. Use it for the little jobs around the shop also for the biggest ones—the results will be equally satisfactory.

By the Carbic System acetylene is generated from Carbic Cakes—the system that is different.

It means **portable** equipment which can be taken wherever needed—absolute safety—acetylene at half the cost of that furnished in cylinders and an assured supply of gas.

And remember, the Carbic System will handle oxy-acetylene welding and cutting jobs—large or small.

Write for catalogs and complete information and learn what the Carbic System can do for **you**.

The Carbic line is complete, including generators, torches, regulators and all other necessary apparatus and supplies.

Carbic Manufacturing Company

Duluth, Minnesota

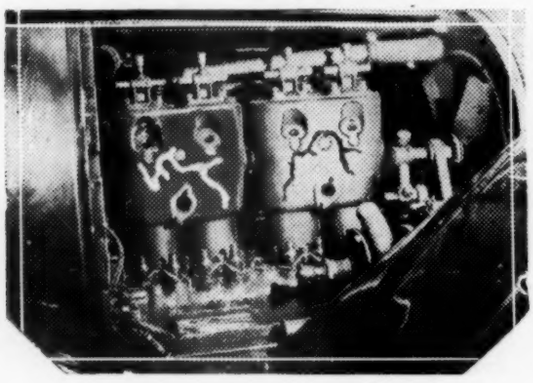
DULUTH, MINN. Factory and General Office	BOSTON, MASS. 27 School St.	NEW YORK, N. Y. 141 Centre St.	CHICAGO, ILL. 565 W. Washington Blvd.
ATLANTA, GA. 169 Haynes St.	CHARLOTTE, N. C. W. 9th St. & So. Ry.	KANSAS CITY, MO. 1411 St. Louis Ave.	EL PASO, TEX. 412 Myrtle Ave.
DENVER, COLO. Hendrie & Bolthoff M. & S. Co.	LOS ANGELES, CAL. 606 Roberts Bldg.	NEW ORLEANS, LA. Woodward, Wright & Co.	DALLAS, TEX. Briggs-Weaver Machinery Co.

Warehouses and Representatives in other principal cities.

Carbic Cakes save money, time and patience, and yield a purer gas

Are You Welding Cracked Water Jackets and Broken Crank Cases in Place?

Furnace Sections also

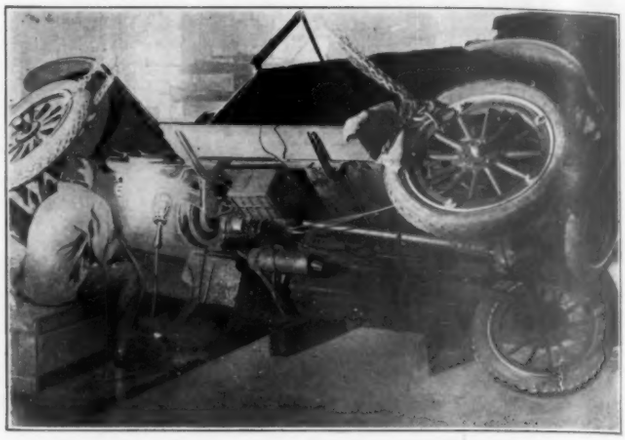


Cracked Water Jackets Welded in Place

No Preheating

No Dismantling

No Warping



Broken Crank Cases and How to Get at Them

These are exact and voluntary copies of letters received recently from L. A. Hacker, Mr. Porter C. Roberts, of the Whitney Bros. Co., located in Santa Cruz, Cal., and Mr. W. D. Baugh, proprietor of the Greenwood Welding Work, Greenwood, Miss.

"In answer to your question of how I am making out in regards to electric arc welding, I must say that the process has been a huge success.

Since adding your equipment, our shop has grown from an eight by twenty building into a real welding establishment.

We have added much valuable and expensive machinery to our shop, but all of this has done no more towards the success of the shop than the Alternarc Standard Welder.

During the past year, while doing welding for outside firms, I have had the pleasure, or rather inconvenience of using several makes, late models, of electric arc welding machines. Some of these machines were direct current type, others were A. C. The direct current machines were sluggish, very heavy and clumsy to move about, gave trouble with their bearings, and, worst of all, gave very poor penetration.

The competitive A. C. machines were very frail, gave trouble by overheating and were nowheres near as compact and portable as the 'Alternarc.'

My machine is rated at 200 amps. maximum capacity, but it really develops much more than this. We rarely ever tap more than half of the machine's energy, except when using the carbon arc. From fender welding to railroad rails is the ability of this machine.

My idea of a perfect arc welding machine is—a machine that is capable of doing very light work, as well as extremely heavy work; gives deep penetration without burning the metal, has a steady, free flowing arc, which is easy to maintain, has few moving parts, and must be portable, so that it can be moved easily from shop to outside jobs.

After a good deal of experience with different welding machines, I find that the 'Alternarc' A. C. Welder has all of these desirable qualities, and is, in my way of thinking, the peer of them all."

Yours very truly,
(Signed) Porter C. Roberts.

"Had the big freeze in January that I have craved ever since buying my machine, and I have simply mopped up. Did enough arc welding to buy a brand new Alternarc last month alone.

Yours for electric welding,"
(Signed) W. D. Baugh.

Mr. L. A. Hacker, of 529 N. Main St., Vernon, Texas.—I pay $5.00 minimum power bill with the installation of your machine, and the bill runs from $4.50 to $8.00 per month at my shop, and I do all the work possible with this machine. I do more than ⅔ of the welding with my electrical machine, and if it were not for cutting with gas, I could almost dispense with my old tools. Of course I weld aluminum with gas also, but most of my work is done with the electric, and the bills average under $6.00 a month. My bills for gas used to run from $60.00 to $80.00 a month, and the electric machine has reduced it to that amount. (After using our machine eighteen months, he has made enough money to build a brick building, and he voluntarily states it is practically due to the advent of our apparatus.) Also, your machine is the best ever, and I would not part with it under any circumstances.

These are voluntary letters received this month from "Alternarc" customers. The "Alternarc" has simply mopped up. So has our Instruction Hand Book. Have you sent for your copy?

ELECTRIC ARC CUTTING and WELDING CO.

152-156 Jelliff Avenue,

Newark, New Jersey

Tank Welding and Cutting

EA-15